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Psychophysiological Parameters of Emotional Expression.

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Psychophysiological Parameters of Emotional Expression

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Abstract

Patterns of physiological responses to visually presented stress stimuli were examined in subjects differing in cognitive style--field dependent (FD) and field independent (FI) and trait--high (HA) and low (LA)--anxiety. Six electrodermal responses, heart rate and respiration as well as state and process anxiety were measured in twenty-four male subjects. Three separate analyses were performed.

In the first analysis, the effects of escape from stress were not significantly different from effects of the nonescape condition as determined by multivariate analysis of variance (MANOVA). However, there was a decrease in tonic GSP, nonspecific exosomatic GSR and heart rate. FD subjects were significantly more reactive and had higher state anxiety scores than field independent (FI) subjects. It was also apparent that different profiles of responses differentiated the four groups of subjects.

In the second condition, personal stressors did not result in a significant difference (MANOVA) when compared with impersonal stressors. However, a significant increase in heart rate, phasic GSP and nonspecific GSR responses was associated with personal stress. Increases in state anxiety also accompanied personal stress.

In the third analysis, high stress stimuli were significantly different from neutral and pleasurable stimuli (MANOVA). Stress generally resulted in elevated skin conductance and phasic GSP and decelerated heart rate but with intergroup differences. FI subjects displayed greater physiological differentiation among levels of stress whereas FD subjects responded with different levels of arousal.

The results may indicate that FI subjects respond as James would have predicted and FD subjects respond consistently with Cannon's theory.

Introduction

As early as 1925 it was reported that there were few subjects on which more had been written than emotion (Wechsler, 1925). Since 1925, the literature on emotion and the many related topics such as anxiety, conflict, frustration, stress, threat, anger, fear, etc., has sizeably increased. Several contexts within which to view emotion have also arisen, including: motivation (Miller, 1948; 1951; 1959); arousal (Malmo, 1957); activation (Lindsley, 1951) and as a response (Freud, 1936; Leeper, 1948; Duffy, 1948; Hebb, 1949; Pribram, 1963; Simon, 1967). Most of these concepts have in common a physiological orientation.

A physiological basis for emotional states was recognized by Nietsche as he described the feeling of benevolence (power) as basically proprioceptive feedback from facial muscles (1994 in Kaufman, 1967). It was another philosopher, however, William James, who suggested a theory of physiological change and emotional feeling.

James (1892) proposed that an object was presumably sensed by the sense organs and apperceived by the appropriate cortical centers. The reflex currents passed through preordained channels and altered the condition of the muscle, skin and viscus. These alterations were apperceived as the original object and were transformed into an object emotionally felt. Therefore, "bodily changes follow directly the perception of the exciting fact, and our feeling of the same changes as they occur is the emotion" (James, 1892, p. 375). Of critical importance in the Jamesian view was that different emotions were presumed to have qualitatively different physiological patterns.

A physiologist, W. B. Cannon, leveled five specific criticisms against

James' formulations (Cannon, 1931).

1.) The latency of visceral changes were too great to account for the immediacy of emotional behavior.

2.) Artificial induction of visceral changes does not produce emotion.

3.) The viscera are "insensitive structures."

4.) Visceral changes are the same for all emotions.

5.) Interruption of afferent feedback from the periphery does not influence emotional behavior.

As an alternative to James' peripheral theory of emotion, Cannon proposed a central theory of emotion. According to Cannon, perception of an object resulted in neural discharge in the thalamus. Conduction over efferent and afferent nerve paths led to verbal report of affective changes as well as somatic and visceral changes. Release from cortical inhibition of neural impulses originating in the thalamus was viewed as the basis of emotional experience and behavior. Different emotions were not qualitatively different in Cannon's view but represented a continuum of sympathetic nervous system discharge or thalamic arousal.

The importance of these two early theories of emotion is that they formally recognized physiological changes as critical to emotional experience or behavior. Although Cannon's theory was couched in physiological (testable) terms and stimulated immediate supportive research, James' more mentalistic notions, such as emotional feeling, seemed to have greater intuitive appeal. However, because of the forcefulness of Cannon's position, qualitative changes during emotional states were not deemed possible.

Many of the more recent theories of emotion are little more than refinements and extensions of James' (Wenger, 1950; Arnold, 1960) and Cannon's (Hebb, 1949; Lindsley, 1951) theory. However the empirical data fail to support unequivocally any one position (see Goldstein, 1968 and Fehr and Stern, 1970 for excellent reviews of the research literature). Perhaps the principles sought to explain the complex process of emotion are too general to be applied to all situations (Davis, 1957; Lacey, 1967) and to all persons (Lazarus, 1968). It may, therefore, prove more productive to examine specific situations and specific reactions or constellations or reactions ("emotions") in selected groups of individuals. Consistent with this reasoning, stress and stress reactions will be emphasized in this paper.

Stress

As suggested by Spielberger, Lushene and McAdoo (1969), stress, threat, and anxiety are often used interchangeably. However, they may be viewed as representing different aspects of a temporal sequence. Stress may be defined as variations in environmental conditions or circumstances representing some degree of actual or anticipated danger. Stressors are stimuli associated with stress reactions. The stress reaction may be defined as the variation of an output (physiological, behavioral or psychological) beyond its normal limits (Teichner, 1968).

The study of stress has suffered from overwhelming complexity. One reason for this may be that physical stressors, such as cold pressor and electric shock are treated as analogous to stress due to informational overload, castigation and indirect or symbolically perceived harm. Order may obtain by treating physical or systemic and psychological or symbolic stress as different procedural and conceptual processes.

Physical Stress

The concept of stress was introduced into the biological sciences by Hans Selye (1950). Selye's concern was mainly with physical stress or disease during which adrenocorticotrophic hormone (ACTH) was released. In this context a physiological stress response was thought of as an automatic homeostatic mechanism activated by noxious stimulation. Shock and cold pressor, although often compared with and even termed psychological stress, clearly fit Selye's notion of physical stress.

Psychological Stress or Threat

Although psychological stressors have included novelty, isolation, boredom, fatigue, castigation and mental arithmetic, psychological stress might best be defined as a stimulus or set of cognitive expectations which leads the individual to anticipate harm. It is important to note that the harm need not occur but that impending harm be communicated to the subject (Janis, 1958). As Lazarus (1967) has suggested, the effects of psychological stress are determined by the process of appraisal of the stimuli (either symbolic or manifest) and a set of coping behaviors (avoidance, defense mechanisms, etc.) instituted by the individual to deal with the perceived threat.

Emotional Response

The emotional reaction evoked in individuals who interpret specific situations as personally threatening may be termed anxiety (Spielberger, Lushene & McAdoo, 1969). Implicit in this view is that anxiety or emotion is a response to stress, not an intervening variable such as drive. There are at least two approaches to the study of anxiety or to the physiological reaction to stress. One approach, consistent with Cannon's reasoning, is to examine arousal or sympathetic discharge. A second view searches for patterns of autonomic responsivity which either sets groups of subjects, situations or emotions apart. The latter view is consonant with James' formulations.

Physiological Arousal

The traditional view of emotional stimuli was that they were physical energy fortuitously conditioned as positive or negative. The intensity of the emotion was thought to be proportional to the force of physical energy invested in the stimuli. When stimulated, the organism was mobilized for activity by central, peripheral and metabolic processes. This view recognized emotion as a continuum of arousal on a unidimensional scale and ignored qualitative differences between emotional states. Duffy's (1948) proposal of energy mobilization was an attempt to interpret this dimension of arousal.

Most of the early research interpreted in support of the arousal position ignored the possibility of autonomic patterning and therefore measured only one response modality. Other supportive research neglected the possible influence of the parasympathetic nervous system and was concerned solely with sympathetic activation (Cohen, 1967).

In support of the arousal position, Lindsley (1951) collated electroencephalographic data and determined that during states of emotion there was a reduction or abolition of synchronized alpha rhythm and an induction of low amplitude fast activity. Peripherally, a decrease in skin resistance or an increase in skin conductance (GSR) has been reported as an index of emotional response to stress (Cohen, Silverman and Burch, 1956; Oken, 1962; Alfert, 1966; and Geer and Klein, 1969). Heart rate increases (Oken, 1962; Siminov, 1969), forearm vasodilation (Rosenberg, 1970), digital constriction (Sokolov, 1963), and increased secretion of ACTH, aldosterone, epinephrine and norepinephrine (Oken, 1967) have been reported as emotional responses evoked in stressful circumstances.

However, in a seminal test of arousal theory, Schacter and Singer (1962) simulated sympathetic discharge in subjects by injecting them with epinephrine. The subjects were then given appropriate, inappropriate or no explanation of the drug effect and provided "emotional" cues by a confederate of the experimenter. The subjects who were given no explanation of the drug effect were not influenced by the emotional cues. It was concluded that emotional states are characterized by activation or arousal in a few physiological variables but that activation alone does not account for the emotional response.

Measures of arousal have been reported to be consistent across several stressors. Alfert (1966) reported that responses to a vicarious threat can be used to predict response to direct threat. However, in a more refined treatment of the data, Alfert (1967) reported personality differences in response to vicarious and direct threats.

As suggested by Lazarus (1966), it is unreasonable to reduce all emotional experience to a single continuum of arousal. It is conceivable that different emotions reflect different bodily states as well as different cognitive and coping processes. A second objection to arousal theory is that physical exertion, such as climbing a flight of stairs, may require energy mobilization and reflect physiological signs of arousal, i.e., sympathetic processes, yet may not include emotional experience. The investigation of patterns of emotional response to various stressors does, in view of these objections, seems compelling.

Autonomic Patterning

A search for patterns of autonomic functioning in different contexts has been catalized by the lack of significant correlations among measures of emotional reaction. Hsü (1952) reported correlations of between .15 and .46 between galvanic skin response (GSR) and verbal reports of stress to emotionally toned words. He concluded that the self report dimension was collaborative but not identical with physiological measures of stress. Lacey (Lacey and Lacey, 1958; Lacey, Kagan, Lacey & Moss, 1963) has reported that baseline skin conductance level is independent of resting heart rate. In addition he has reported that skin conductance was related to tachistoscopally presented pictures in a stressful situation whereas heart rate was not related. In other stressful situations nonsignificant correlations between subjective states of anxiety and adrenaline-noradrenaline secretion (Zubek, Bayer, Milstein and Shepard, 1969), and the anxiety adjective check list (AACL), skin conductance and heart rate (Folkins, Lawson, Opton and Lazarus, 1968) have been reported. The correlations between physiological measures of stress and psychiatric assessment of anxiety have also been reported to be low, but as stress increases the correlations were noted to rise (Dykman, Reese, Galbrecht, Ackerman and Sundermann, 1968). Lazarus (1967) has found that intraindividual correlations are generally higher than interindividual correlations. The within subject correlation has been reported to be about .50; however, Lacey (1967) has expressed skepticism regarding these coefficients. Lazarus' contentions have received support, however, from studies of interview measures of stress and simultaneous physiological recording (Reese, Sundermann, Galbrecht & Dykman, 1969; DiMascio, Boyd and Greenblatt, 1957). The latter study involved the monitoring of one patient through eleven psychiatric interviews. A correlation of .69 between heart rate and rated anxiety and a correlation of -.37 between heart rate and antagonism was reported. The general findings suggest low intersubject correlations among measures of stress. Increased stress results in increased between subject correlation and intrasubject correlations tend to yield the highest correlation coefficients. It may be instructive to emphasize Hsü's (1952) conclusion that physiological measures of stress may be collaborative but different from emotional feeling.

An alternative strategy to correlating measures of stress is to demonstrate patterns of responses which occur to different stimuli or situations, or which distinguish groups of subjects. Although proposed by William James in 1884 and having intuitive appeal, the goal of replicable patterns of response has been somewhat illusive. Part of the difficulty is of a technical nature and is reflected by the fact that fractionation of electrodermal (EDR) phenomena have remained obscure. Therefore a great portion of the literature on patterns of response pertains to the cardiovascular system and much of this research only peripherally involves emotion.

Darrow (1929) recognized that ideational stimulation resulted in heart rate acceleration while sensory stimulation led to heart rate deceleration. GSR was reported as being more responsive to sensory stimuli but also to disturbing ideation. More directly related to emotion, Beebe-Center (1932) found that pleasant stimuli resulted in acceleration of heart rate while unpleasant stimuli had the opposite effect.

Lacey (Lacey, Bateman & Van Lehn, 1953; Lacey, Kagan, Lacey and Moss, 1963; Lacey, 1967) extended the methodology and precision of the heart rate studies and has reported that heart rate acceleration generally accompanies sensory dislike, environmental rejection or thinking, and such stimulus situations as mental arithmetic and cold pressor. Heart rate deceleration is associated with sensory attraction and attention to the environment, especially with respect to visual and auditory inputs. Lacey has termed the phenomena of an arousal response which is contrary to sympathetic activity, directional fractionation (termed reversal by Teichner, 1968). Although Lacey reports that skin conductance generally increases in all these conditions, he sponsored the notion of response specificity. Response specificity refers to the finding that in a given subject, maximal activation on one physiological variable will be consistent. Lacey also reported that response hierarchies remain consistent on repeated exposure to the same stressor. This phenomenon has been termed intrastressor stereotypy of response. Lacey finds that individuals maintain their relative rank on response measures with different stressors even though some conditions evoke specific patterns of physiological response. Therefore an individual who may be a GSR responder may give the largest GSR response in all conditions. However, in some conditions heart rate may be the primary response evoked. In this case he may show his maximal activation with heart rate yet he will maintain his rank among subjects on the GSR (Lacey, Bateman, Van Lehn, 1953; Lacey, 1959; Lacey, 1967). This latter phenomenon has been termed situational stereotypy of response.

Lacey's findings that heart rate acceleration accompanies environmental rejection and heart rate deceleration is associated with environmental acceptance has been independently replicated (Obrist, 1963; Edwards, 1968). Campos and Johnson (1967) extended Lacey's findings to examine the effects of verbalization on heart rate responses. They found that subjects who were allowed to verbalize their reactions to slides in an emotionally toned situation had deceleration in heart rate. Subjects not allowed verbalization produced increases in heart rate. This suggests that an active interchange with the environment produces heart rate deceleration whereas a passive acceptance yields heart rate acceleration.

Physiological studies of fear and anger have been especially popular in the search for patterns of emotional states. Wolf and Wolff (1947) reported an increase in motility, secretion and vascular dilation of the viscera associated with anger. These patterns were noted to decrease during states of depression. Ax (1953) in a widely quoted study reported that anger produced increased diastolic blood pressure, decreased heart rate and increases in the incidence of specific skin conductance responses. Fear, on the other hand, resulted in increased heart rate and skin conductance. Schacter (1957) and DiMascio, Boyd and Greenblatt (1957) reported similar heart rate data for fear and anger conditions.

Although a bidimensionality of electrodermal responses has been discussed (Darrow, 1964; Edelberg & Wright, 1964; Forbes, 1964; and Wilcott, 1964), few studies have demonstrated differential responses with respect to experimental manipulations. Katkin (1965) and Miller and Shmavonian (1965) reported that stress resulted in an increase in nonspecific responses (responses occuring in the absence of external stimuli or conditions) and an increase in basal conductance. Cognitive activity resulted in few nonspecific responses and an increase in basal conductance. Miller and Shmavonian (1965) speculate that a perceptual component of the GSR resides in the stratum lucidem and that a defensive component lies in sweat gland activity. Miller (1967) added support to this hypothesis utilizing a rarely employed measure, skin potential. He found that tonic negative responses occurred in response to cognitive activity and phasic and biphasic responses accompanied stress conditions. Further support for response fractionation was developed by Geer and Klein (1969) for they reported that GSR's to dead bodies were augment by the threat of shock. They suggest that GSR is responsive to the content of the stimuli whereas heart rate is related to the threat value of the situation. This suggests that different response modalities reflect different conditions but is notably different from the findings of Lacey and of Mandler, Mandler, Kremen and Sholiton (1961) in which heart rate was hypothesized as reflecting the content of the stimuli.

Although few experimenters have attempted to examine the parameters of even one physiological variable, an even smaller number have attempted to map a profile of several physiological variables. A notable exception is R.C. Davis. In an extensive review of his own research, Davis (1957) presents four basic patterns of responses to simple visual stimuli, complex visual stimuli, cutaneous stimulation and motor activity. Generally, Davis found that skin conductance and the electromyogram increased in response to all of these conditions. The fractionated responses were, again, associated with the cardiovascular system and respiration.

Another team of researchers led by Dykman (Dykman, Ackerman, Galbrecht & Reese, 1963; Dykman, Reese, Galbrecht, Ackerman and Sundermann, 1968) have painstakingly mapped out several patterns of physiological responses associated with personality dimensions. They have called attention to the fact that the subject's level of functioning at the time of stress, the level of stress, and personality variables, especially defensiveness, influence the pattern of response observed. Four basic patterns have been described by Dykman's team. The alerting pattern is characteristic of high anxious, low defensive subjects and consists of decreased skin resistance and increased heart rate and respiration rate. A closed pattern has been described for high anxious, high defensive subjects and entails a stable skin resistance while heart rate and respiration rate increases. The open pattern defined the low anxious, low defensive, subjects' response to stress and it involved a decrease in skin resistance, heart rate and respiration rate. The fourth pattern was termed nonresponsive. It was also noted that high anxious subjects without defensive behavior evidenced massive sympathetic activity.

Within the past ten years a far greater number of experimenters have recognized the importance of measuring more than one physiological response. Although only a few studies in this section dealt with emotion, the studies reviewed may provide another style with which to examine manners of dealing with the environment. It is apparent that there are at least two dimensions, rejection and acceptance of the environment. This may correspond to the classifications of anxious and defensive subjects as well as defense mechanisms characterized by vigilance or orientation toward the environment (Glad & Glad, 1963) such as intellectualization; and those characterized by avoidance or orientation away from the environment (Glad & Glad, 1963) such as denial.

It is somewhat surprising that few studies have examined the relationship between physiological response and behavior. In fact, in an extensive review of the research literature, Martin (1961) claimed that no such study was found. In the next section it will be apparent that although few studies in this category exist at least the importance of this relationship is recognized.

Factors Affecting Physiological Response To Stress

Physical or physiological changes, psychological or cognitive changes and behavioral avoidance have direct effects on manifestations of emotional responding.

Physiological Factors Influencing Emotional Responses

Working on the assumption that all connections between the sympathetic nervous system and the central nervous system (CNS) lie between the eighth cervical nerve and the fourth lumbar section, an early test of the James position was to sever this area. The studies of Sherrington (1900) and of Cannon, Newton, Bright, Menken and More (1929) demonstrated that animals evidenced emotional behavior even with this afferent system severed. This was interpreted as proof (Cannon, 1931) that afferent feedback from the periphery (specifically the viscera) was not necessary for emotional behavior. In support of this proposition, Solomon and Wynne (1950) adduced some evidence that sympathectomized dogs may be more emotional than control animals.

A further extension of Cannon's proposal was suggested by studies with decorticate cats. Bard and Mountcastle (1948) described sham rage as the result of decortication with the thalamus intact. The rage was eliminated in the decorticate animals by lesioning the thalamus (Bard, 1950). These data have been interpreted in support of Cannon's position that emotional expression is a thalamic phenomenon. Contrary data, however, in terms of emotional flacidity following neocortical lesions, has been reported in monkeys (Klüver and Bucy, 1939).

Even though the assumption that sympathetic nervous system feedback to the CNS lies between a small circumscribed area has been proven in-correct (Sweet, 1959), two interesting studies with human spinal lesioned patients might be interpreted as favoring James' position. Hohmann (1966) interviewed spinal lesioned patients and discovered that these patients experienced a decrease in emotional feeling especially with respect to sex, fear and anger. The patients reported, however, that the overt behavior of the emotion continued for others expected it to--it was a learned social role. This suggests that the distribution of the autonomic nervous system and its afferent return resulted in a disturbance of the experience of emotion while the (sham) behavior of emotion continued. Although solid experimental evidence for this relationship is lacking, McDaniel and Sexton (1970) reported affective disturbances as measured by adrenalin-noradrenalin output during naturally occuring stress in spinal lesioned patients. A curvilinear relationship between adrenalin-noradrenalin secretion and affective arousal was reported.

The effects of injections of sympathomimetic drugs have also led to equivocal conclusions. Earlier studies (Cantril and Hunt, 1932) reported that adrenalin injections led to arousal. The contention that fear and anger could be differentiated by adrenalin-noradrenalin concentrations also was popular (Funkenstein, 1956). However, in the already reviewed study of Schacter and Singer (1962), the complex interaction of psychological set, emotional cues and the drug effect became clear. It was concluded that cognitive expectations might play a very large role in the subject's reaction to a drug.

<u>Psychological Factors Influencing the Response to Stress</u>

One emotional response to stress might be termed anxiety. Freud (1936) proposed that in nonpathological conditions, anxiety served a signal function to inform the individual that he was in danger from instinctual impulses. In order to overcome the danger, a self deception in the form of psychological defense mechanisms was activated. This was contrasted by Freud with neurotic anxiety which was distinguished as free floating, objectless and internally derived.

Some confusion as to whether anxiety itself, or the danger it signals, is defended against has been apparent in the literature (Lazarus, 1966). In the model proposed by Lazarus (1968) this is not an issue since the appraisal of threat (as determined by coping processes) is thought to determine the degree of arousal (anxiety). In this context, anxiety is considered the response to stress and not an intervening variable. The influence of coping or cognitive factors on physiological stress responses has been illustrated in a number of studies, most of which are relatively recent.

Mandler, Mandler, Kremen and Sholiton (1961) developed a paradigm in which subjects gave their associations to conflictual phrases. The defensive characteristics of the associations were rated and physiological recordings were taken. There appeared to be a high correlation between physiological arousal, avoidance (passive) and interference, and a negative correlation between the physiological variables, denial and rationalization. Subjects scoring high on the K scale of the MMPI differed significantly from high anxious subjects on the physiological measures. These data suggested that the defensive posture of subjects greatly determined the level of physiological arousal.

For some (Berkun, Bialek, Kern and Yagi, 1962) the "interference" of the cognitive defenses makes it difficult to study the effects of stress. In an attempt to study combat simulation stress, and measure subjective report, performance and adrenal activity, these authors expressed concern that unless the cognitive defenses were overcome it would be impossible to study stress. However, quite an opposite view is taken by Lazarus and his associates.

In a series of ingenious studies, Lazarus has demonstrated that cognitive factors significantly influence the stress response. The paradigm employed by the Lazarus group is to show subjects a stressful film, either depicting primitive circumcision rituals or workshop accidents. During the film, physiological recordings are taken, usually skin resistance and heart rate, along with a self report measure of anxiety. In at least one study (Weinstein, Averill, Opton and Lazarus, 1968) ratings of anxiety during the film were made.

Viewing the stressful film resulted in increased skin conductance, heart rate and self report and interview measures of anxiety (Lazarus, Speisman, Mordkoff & Davidson, 1962; Speisman, Lazarus, Mordkoff, Davidson, 1964; Lazarus & Alfert, 1964; Lazarus, Opton, Nomikos & Rankin, 1965; Nomikos, Opton, Averill & Lazarus, 1968; Weinstein, Averill, Opton & Lazarus, 1968; and Folkins, Lawson, Opton & Lazarus, 1968). The effects of the film on physiological responses were lessened or "short-circuited" by introducing sound tracks with the pictures. Sound tracks of intellectualization, denial, reaction formation and trauma (emphasizing stressful details) were compared with two populations, students and business executives (Speisman, Lazarus, Mordkoff & Davidson, 1964). The trauma sound tracks resulted in the largest skin conductance increases and, as Lacey might have predicted, both increases and decreases in heart rate. Students short circuited the threat best with the intellectualization sound tracks while the businessmen, to a lesser degree, employed denial and intellectualization. Although based mostly on inference, the authors concluded that the sound tracks were most effective when they were congruent with the subject's cognitive predisposition.

Lazarus and Alfert (1964) empirically tested the proposition that predispositions enhance the likelihood of employing a defensive set. They concluded that denial works best for subjects who were determined (by the MMPI) as subjec s who were disposed to denial maneuvers. They also found that providing subjects with the defensive set prior to the film was effective in short circuiting the arousal response. This was later confirmed by Lazarus, Opton, Nomikos & Rankin (1965), since providing intellectualization and denial passages prior to the stressful stimuli reduced the physiological responses to the film.

Cognitive rehearsal (desensitization) and relaxation has also been shown to short circuit the stress response to films (Folkins, Lawson, Opton & Lazarus, 1968). Although on skin conductance measures, the control groups remained most reactive and the rehearsal groups least reactive, only the self report measure (AACL) differentiated all of the groups. Kinder (1967) also found decreased skin conductance in subjects who received exact information about, and who rehearsed scenes from, the film Subcision. In this study, however, the effects were only significant for the first stress sequence. The implications of this approach for psychotherapy has been demonstrated by Paul (1970). By simulating therapy, Paul found that relaxation and hypnotic suggestion (rehearsal) reduced stress, tension and physiological arousal.

Nomikos, Opton Averill and Lazarus (1968) found that by manipulating subjects' anticipation of threatening stimuli, the physiological responses were differentially affected. Long anticipation of stressful sequences in a film resulted in greater autonomic disturbance, especially the GSR. Self report measures of stress did not reflect anticipation of threat but were significantly affected by the stressful portion in the film.

Several attempts to replicate the work of Lazarus have suffered from methodological, conceptual and procedural difficulties. However, the results have generally confirmed Lazarus' findings. A group at UCLA have shown subjects the film Wages of Fear and monitored physiological responses. Although the results were mostly nonsignificant the authors concluded that highly defended subjects are better equipped to short circuit threat than subjects with fewer defenses (Goldstein, Jones, Clemens, Flagg & Alexander, 1965).

A relevant addition to the research paradigm employed to measure stress reaction was a behavioral index of involvement. Goldstein and Adams (1967) instructed subjects to press a lever at given intervals in order to continue viewing a stressful film. His subject group was composed of high and low anxious individuals as well as specific and nonspecific defenders (as determined by tachistoscopic perception threshold of emotional stimuli). The findings indicated that subjects who show approach patterns to stress were characterized by high anxiety and did not discriminate stress stimuli from nonstress stimuli. Low anxious subjects who tended to avoid stress showed minimal GSR reactivity and low anxious nonspecific defenders displayed maximum GSR activity.

A second addition to the research paradigm was the employment of personally involving psychological stress. Though this issue has been recognized by a few authors (Katkin, 1966; Rimm & Litvak, 1969; Geer, 1966) very little research has been conducted to test this aspect of stress responding. An exception was a study by Waters (1970) which attempted to gauge a stress response from a series of statements a subject had been led to believe had been made about him. The subject was provided with four types of responses he could give to the statements. These were rated on an a priori basis for effectiveness in reducing the impact of the statements. Despite the intricate methodology, the data suggest that freely emitted defensive responses resulted in a significantly faster rate of skin conductance and heart rate recovery than nondefensive responding.

Another approach to the study of stress reactions is to employ groups of subjects who differ in the type of defensive or cognitive set they employ in dealing with the environment. Luborsky, Blinder and Schimek (1965) employed a measure of looking time and recall in order to compare isolators with repressors. They found that isolators look around more and recall more of the stressful stimuli. Skin conductance correlated significantly and positively with repression. The authors concluded that awareness was narrowed by repression and broadened by isolation.

In a study beset with conceptual and methodological difficulties, Simal and Herr (1970) examined the physiological correlates of the repression-sensitization dimension. Sexually conoted stimuli were defined a priori as stressors and skin resistance measures were recorded as the stress responses. The authors concluded that, since they found nonsignificant differences between the groups, the repression-sensitization dimension represented a cognitive rather than an emotional continuum. Using skin conductance measures and heart rate, however, Weinstein, Averill, Opton and Lazarus (1968) found that repressors are more automatically reactive than sensitizers.

Ego strength has also been related to autonomic functioning. As measured by the MMPI, ego strength has been associated with a higher incidence of response specificity and stereotypy than low ego strength (Roessler, Greenfield and Alexander, 1964). Schizophrenics (low ego strength) do not differ from normals in response to a stressful film, however they do evidence faster resting heart rate than normals (Goldstein and Acker, 1967). Autonomic activity can be dampened in schizophrenics with administration of phenothiazine (Goldstein, Acker, Crockett and Riddle, 1966).

From the preceeding review it is apparent that cognitive factors do interact and influence, maybe even determine the stress response. However, the reverse situation has also been suggested since decreased awareness accompanies stress (Callaway and Thompson, 1953). It might be concluded that the evidence strongly suggests that cognitive manipulations and the comparison of different personality types results in different patterns of autonomic response to stress. The effectiveness of avoidance in short circuiting stress, however, has not been directly tested though data is available on the general nature of avoidance.

Effects of Avoidance and Escape on Stress Responding

As suggested by Gellhorn (1964) there is a tendency to ignore the "motion" in the word "emotion." That there is "motion" or activity during emotional states is apparent from the foregoing review since somatic and autonomic discharge is a significant correlate of feeling states. In addition, it is a curious observation that animals which defend themselves with movement, such as the turtle, show little evidence of fear (Solomon, 1927). Movement, escape or avoidance of stress may be considered a coping response to the presence of stress. Cannon (1929) inadvertently suggested such a conclusion by examining blood sugar content of Harvard football players. Players who had not played and one spectator had higher glycosuria levels than those who had played suggesting that action itself served to short circuit excess sugar release.

The notion that some form of organized behavior acts as a coping response and may tend to reduce the level of arousal was not confirmed in an early study with monkeys. Brady, Porter, Conrad and Mason (1958) found that executive monkeys, that is, ones able to make decisions and avoid shock, developed gastrointestinal ulcers whereas their yoked control did not. However, as reviewed by DiGiusto, Cairncross and King (in press) the presence of stress without a coping response has generally been the condition which produced ulceration.

As predicted by Mowrer (1947) and experimentally verified (Kamin, Brimer and Black, 1963), during the typical active avoidance conditioning procedure an animal becomes fearful of the conditional stimulus, and then as conditioning proceeds, and the animal makes a long run of correct responses, the fear subsides. The avoidance response, then, acts to reduce the fear. In support of this contention Weiss (1968) found that rats able to avoid shock had less severe gastric lesions than yoked controls. Miller (1969) has reported that rats able to escape shock suffer less extensive stomach lesions and weigh more than rats without a coping response. Shock induced fighting results in less pituitary ACTH release than exposure to shock without the opportunity to fight (Conner, Levine, Vernikos-Danellis, 1970). This suggests that any organized behavior, in the rat at least, may be considered a coping response.

Similar data have been advanced for human subjects. In a tracking experiment, subjects could avoid shock by performing a task well. It was found that subjects who successfully avoided shock were less anxious, as measured by a paper and pencil test, than subjects not given the opportunity to avoid shock (Wachtel, 1968).

It has been suggested, also, that organisms having control over the onset and offset of stress stimuli show evidence of decreased anxiety or arousal (Mandler & Watson, 1966; Mandler, 1967). Miller (1969) reported that unpredictable stressful stimuli caused higher rectal temperature and larger stomach lesions in rats than predictable stimuli. In human subjects, the opportunity to administer shock to oneself results in lower skin resistance changes than when an experimenter controls the shock (Haggard, 1943). Similarly, subjects offered the opportunity to choose in which order they wished to take WAIS subtests had a less reactive GSR than subjects not given a choice (Stotland & Blumenthal, 1966). The literature suggests that the opportunity to avoid, escape or control the stimulus changes the anxiety or arousal response.

Problem

Stress research is encumbered with conceptual and procedural difficulties. Stress has been defined by such divergent operations as shock, cold pressor, mental arithmetic and stressful films. Measures of stress responses have included physiological and self report indices. The approaches to the study of the "dynamics" underlying the response to stressors have included inducing an activated physiological state, inducing a cognitive set, or comparing the responses of different groups of subjects.

A valuable contribution to the research on stress might be made by examining multivariate patterns of responses to stress. Consistent with this notion, physiological, self report and behavioral correlates of stress responding were examined in groups of subjects differing in cognitive style and affective lability.

Independent Variables

Field dependence-independence. Cognitive style as defined by field dependence and field independence is related to three major groups of personality characteristics. General passivity in dealing with environment is a correlate of field dependence while activity in dealing with the environment describes the field independent subject (Carrigan, 1967; Rosner, 1957). Field dependence is associated with lack of self awareness and poor control of impulses with an accompanying fear of aggressive and sexual impulses, whereas field independence is correlated with awareness of inner life and effective control of impulses (Minard & Mooney, 1969). While low esteem characterizes the field dependent subject, high self esteem and confidence in bodily sensations are associated with field independence (Pillsbury, Meyerowitz, Salzman and Satran, 1967).

In addition to the personality differences, physiological differences appear between field dependent and independent subjects. Field independence, when compared with field dependence, has been related to an increased ability to, autonomically, differentiate meaningful from non-meaningful stimuli (Courter, Wattenmaker & Ax, 1965; Hein, Cohen, Shmavonian, 1964; and Pillsbury, Meyerowitz, Salzman & Satran, 1967); faster autonomic conditioning in a classical conditioning paradigm (Hein, Cohen & Shmavonian, 1964; 1966); greater autonomic "stability" (Hustmeyer & Karnes, 1964; Block, 1957); greater and prolonged GSR responsivity to specific external stimuli as well as basal resistance decreases (Cohen, 1967; Silverman, Cohen and Shmavonian, 1961); less physiological activity in perceptual isolation experiments (Cohen, Silverman & Shmavonian, 1962); better tactile localization and laterality discrimination (Cohen, 1967); and heart rate deceleration while field dependent subjects show heart rate acceleration in anticipation of an unconditioned stimuli (Dronsejko, 1969).

The findings that field dependent subjects are not as "accurate" in terms of their autonomic responses in a classical conditioning paradigm receives conceptual support from a study designed to measure the influence of emotion on perception (Minard & Mooney, 1969). In this study, poorly differentiated subjects (field dependent) evidenced no separation of emotion and perception. It was suggested that some interference of incoming stimuli might account for the perceptual differences observed. Of related significance is the finding that field independent subjects spend more search time looking at areas of high information content (Conklin, Muir & Boersma, 1968).

Cohen (1967) has speculated that the psychological and physiological differences found between field dependent and independent subjects might reflect differences in hypothalamic reactivity. It is also suggested that field dependent subjects may react in a more disorganized, primitive manner and rely on perceptual cues whereas the field independent subject tends to rely on proprioceptive cues.

From the review of the physiological and psychological data it is apparent that the field dependence continuum is congruent with other classifications such as acceptance and rejection of the environment (Lacey, 1967), avoidance versus vigilance (Goldstein, Jones, Clemens, Flagg & Alexander, 1965), orientation toward and orientation away from the environment (Glad & Glad, 1963), isolation and repression (Luborsky, Blinder & Schimek, 1965) and the factor analytically derived approach and avoidance mode of response (Endler, Hunt and Rosenstein, 1966). Since intellectualization may be thought of as a defense which operates by "consuming" environmental inputs and reappraising threatening stimuli in such a manner to reduce their threat value, it may be reasoned that this approach to stress is similar to a field independent approach. In support of this contention, Schimek (1968) has found a significant correlation between field independence and intellectualization as determined from projective test data. Denial may be conceptualized as a rejection of the environment and an orientation away from it, thereby avoiding the threatening stimuli (Witkin, 1965).

Trait anxiety. The evaluation of the effects of anxiety on physiological responding has become clearer with the added notion of trait (reflecting the residual of past experience and determining anxiety proneness) and state (moment-to-moment anxiety dependent on sensory and cognitive feedback and serving a signal function) anxiety (Cattell & Scheier, 1958; Spielberger, 1966). The effects of trait anxiety on physiological responding has been widely researched with rather consistent results.

Increases in sympathetic activity in subjects manifesting high anxiety scores has been reported by a number of authors (Koepke & Pribram, 1966; Smith & Wenger, 1965; Jackson & Barry, 1967; Malmo, 1957; Fiorica & Muehl, 1962; Geer, 1966; McDaniel & Sexton, 1970). It has been demonstrated that subjects low on trait anxiety demonstrate specific increases in state anxiety and physiological measures whereas high trait anxiety subjects respond in a disorganized manner (Hodges & Spielberger, 1966; Spielberger, 1966; Glickstein, in Lazarus, 1967; Katkin & McCubbin, 1969). It is also evident from the literature that anxiety impairs perception (Angyal, 1948) to the point that it distorts the awareness of the self as a thing separate from the environment (Schmacher, Wright & Wiessen, 1968).

Dykman, et al. (1968) has demonstrated a high anxious pattern which consists of a decrease in skin resistance, decreased heart rate and increased respiration rate. Subjects highly defensive (high K scale on the MMPI) typically have lowered skin resistance, increased heart rate and decreased respiration rate.

Stressors. In order to determine patterns of response to stress, three experimental conditions were employed. In the first condition the result of escape from stress was compared with a non-escape condition. It has been shown (Goldstein and Adams, 1967) that avoidance of stressful stimuli results in decreased GSR reactivity. However, very little evidence is available concerning the effectiveness of escape in short circuiting stress in human subjects. A further refinement can be obtained by comparing subjects who are disposed to escape maneuvers (field dependent) with subjects who might tend to restructure the input (field independent).

In the second condition, impersonal (ego dystonic or vicarious) stress was compared with personal (ego syntonic or direct) stress. In order to serve a signal function, the threat invoked to warn the individual of impending psychological harm should, it seems, be personally involving or of relevance to the subject. Although cold pressor and shock are direct threats to subjects, they have minimal ecological validity since they are not "real" events nor do they offer a threat to self esteem. As suggested by Endler, Hunt and Rosenstein (1962) threat to interpersonal status, self esteem or ego stress, composed the foremost factor in anxiety scores. Therefore, stressors which serve as attacks on the ego more closely fit the notion of signal anxiety suggested by Freud (1936) and moment-to-moment state anxiety, and thereby necessitate defensive maneuvers by the subject.

Although stress which is relevant to a given subject has been reported to increase physiological arousal (Geer, 1966; Waters, 1970), very little research has been conducted comparing impersonal stress with personally involving stress.

The third analysis involved the comparison of high stressors with low stressors which occurred within each of the first two conditions. Again, very little, if any, evidence exists which has compared a system of physiological variables in subjects differing in cognitive style and affective lability in terms of their responses to stress.

Hypotheses

Condition 1

1. Conditions in which subjects can escape stressful stimuli will serve to decrease physiological reactivity.
2. Vigilant subjects (FILA) will be the most reactive subjects in the escape situation. Conversely, FD subjects, whose primary mechanism of defense involves avoidance or escape from stress, will be the least reactive in the escape situation.
3. FD subjects will view the stimuli less than FI subjects and this tendency will be exaggerated in HA subjects.
4. Self report measures of anxiety will be lower in the escape condition than the non-escape condition.

Condition 2

1. Personally involving stress will result in greater physiological reactivity when compared with impersonal stress, especially in FILA subjects.
   a. HA subjects will respond, generally, with sympathetic activation.
2. Personally involving stress will result in elevated anxiety scores, especially in LA subjects when compared with impersonal stress.

Condition 3

1. Patterns of physiological responding will differentiate FI and FD subjects with respect to stress and nonstress stimuli.
   a. FI subjects will display a "cognitive" pattern of increased skin conductance, increased basal conductance, increased

tonic GSP, decreased heart rate, increased nonspecific GSR's and increased phasic responses following high stress stimuli when compared with nonstress stimuli.

b. FD subjects will respond with increased skin conductance, stable basal conductance, increased phasic GSP and GSR nonspecific activity and increased heart rate. It is expected that FD subjects will not discriminate between stress and nonstress stimuli as well as FI subjects and this will be especially true for FDHA subjects.

2. Since FI subjects are more receptive to proprioceptive feedback than FD subjects, the FI subject's introspective report will correlate higher with physiological measures of distress than FD subjects. For the FI subjects all correlations should be positive except heart rate which will be negative.

    a. Since the personal stress condition is hypothesized to be most stressful condition, the correlations between the physiological and psychological indices should be higher during the personal stress, especially for FILA subjects.

Method

General Design

The statistical model was a repeated measures 2 x 2 x 2 factorial design. The between Ss factors were field dependence-independence and trait anxiety. The within Ss factor was the type of stress the subjects (Ss) received, either personal, impersonal non-escape or impersonal escape, and either high or low stress stimuli. The subjects were tested in a balanced order as determined by a Latin Square design (Appendix A).

Subjects

Twenty-four male subjects from introductory psychology classes with extreme scores on field independence-field dependence and trait anxiety (Spielberger, Gorsuch & Lushene, 1969) were drawn from a subject population of forty males (see Appendix B & C for descriptions of the screening battery).

Procedure

All of the subjects chosen to participate in the experiment were administered the MMPI and the DAP prior to coming to the laboratory. On their arrival at the laboratory they were administered the state anxiety scale (Spielberger, Gorsuch & Lushene, 1969). As the electrodes were attached, the subjects were made familiar with a nine-point "distress scale" (Appendix D) and told that they would be shown the scale during the experiment.

They were then taken into the chamber, placed in a reclining chair and told to relax. They were informed that physiological responses to pictures were being investigated and that pictures would be projected on the screen in front of them. A ten minute period allowing the subject to adapt to the laboratory followed. During the ten minute period however, at three minutes and at seven minutes, the rating scale was projected and the subject was requested to rate verbally his level of distress. After the ten minute habituation period five green colored slides followed by five red colored slides were presented to the subject in order to habituate the response to visual stimuli. The slide presentations were of one second duration and had an intertrial interval (ITI) ranging from 15 to 30 seconds. The subject was not informed that these stimuli would appear.

After the habituation series the subject was told that he would see either slides of pictures he might find pleasurable or distressing or statements about him that were derived from test data that had been acquired (see Appendix E for instructions).

The impersonal stress slides consisted of pictures of dead bodies, nude and clothed males and females, landscape scenery, animals, etc. Under one set of conditions the slide remained on for 15 seconds followed by a 15 second ITI. In a second condition, the slides were on for a maximum of 15 seconds but the subject was informed that he could terminate the slide by pushing a key with his right index finger (impersonal escape condition). The personal stress slides contained statements which were projected for 15 seconds with an ITI of 15 seconds and offered no opportunity for escape. Immediately following each slide, the distress rating scale was projected for three seconds and the subject was requested to rate his reaction to the slide on the nine-point scale. All of the slides had been previously rated with the distress scale by an independent sample of 37 subjects (see Appendix F for a description of the slides and their mean distress rating).

Following each stress condition a ten minute "rest" period ensued during which the subjects took the state anxiety questionnaire, recalled as many of the slides as they could, and listed the two slides which they felt were the most distressing.

Following the experiment the subjects were asked to check a statement which most accurately described the way they felt (see Appendix G). The statements were designed to reflect certain defensive postures the subject might assume. The subjects were then completely debriefed with special attention given to the test feedback. They were asked not to divulge the experiment to their classmates until the experiment was over and that complete feedback concerning the results would be made available at the end of the experiment.

Apparatus

Subjects were tested in an 80 db sound attenuated and electrically shielded chamber. The stimuli were projected on a screen in the chamber by a Kodak Carousal slide projector programmed for automatic advance and stimulus presentation with BRS Foringer Digibit logic units. A key was placed on the arm of the S's chair to abort the stimulus in the escape condition. Physiological recording was done with a Grass, Model 7 polygraph, equipped with appropriate bridges, preamplifiers and driver amplifiers. The voltage or resistance measures were written out on Grass oscillographs providing graphic representation of the physiological activity.

Respiration. The respirometer consisted of a sliding piston mounted on an elastic band and placed around the S's chest. A photocrystal in one end of the piston served as an arm of the resistance bridge. The resistance of the photocrystal was modulated by a small light in the opposite end of the piston and was determined by the distance between light and the photocrystal. The distance between the light and the photocrystal was determined by the excursion of the S's chest which relates most directly to respiration. The varying voltage of the resistance bridge was written out on Grass oscillographs providing graphic representations of the S's respiratory activities.

Heart rate. Grass E105 cup electrodes filled with EKG Sol were placed on the lower left rib cage and the right collar bone. The signal was amplified by a Grass Wide Band A.C. Preamplifier and averaged by a Grass cardiotachometer which provided a beat-by-beat record of the heart rate.

Plethysmograph. A photoelectric plethysmograph mounted in a metal ring was placed over the moon of fourth finger on the left hand. A varying voltage was written out on a Grass oscillograph. Only the D.C. component was of interest in this experiment since this provides an estimate of blood volume.

Exosomatic GSR. A curved Ag-AgCl electrode of three cm^2 placed on the volar surface of the second phalange of the right hand served as the active electrode and a curved armband of 58 cm^2 placed on the upper arm served as the inactive electrode of a monopolar placement. A constant current of 20 μa supplied by a Biophysics Model 201 GSR preamplifier was impressed at the active site making that portion of S's epidermis lying between the active and inactive electrodes an arm of a resistance bridge. A bandage with a two cm^2 hole in it restricted the current density to 10 $\mu a/cm^2$ at the active electrode, whereas the current density at the reference electrode was .314 $\mu a/cm^2$. A .05N NaCl solution suspended in an inert plastic medium served as electrode paste. Surface body oils were removed by swabbing the electrode sites with acetone.

Endosomatic GSP. Grass E105 cup electrodes were converted into low standing potential (less that 50 μv), low D.C. drift, Ag-AgCl electrodes. The volar surface of the second phalange of the second finger of the left hand served as the active electrode site and the inner surface of the left forearm served as the reference site. The electrode sites were swabbed with acetone to remove oils and with activity at the reference being abolished by brisk rubbing with a gauze pad. The electrode medium was .05N NaCl in an inert plastic medium. The difference in the standing potential at the two sites was amplified by a one megohm input impedence Grass Model 7 P1 preamplifier and written on the Grass oscillograph. A bucking voltage of opposite polarity supplied by the preamplifier balanced the D.C. potential and kept the oscillograph on channel.

Physiological Data Reduction

Exosomatic GSR

1. The number of non-specific responses of 100 ohms magnitude occuring within the intertrial interval was tallied.
2. Basal conductance changes as reflected in prestimulus levels and defined as the reciprocal of resistance was calculated and presented as mhos.
3. Skin conductance change (ΔC) was calculated as the reciprocal of the sum of all responses during the presentation of the stimulus, one second after onset, by the formula $\frac{1}{R2} - \frac{1}{R1}$, where the prestimulus resistance level = R1 and R2 = the resistance level following the stimulus.

Endosomatic GSP

1. Total negative baseline shifts (tonic response) was expressed

as millivolt change, ΔP.

2. Frequency of a-wave responses as described by Forbes (1964) or phasic response during the stimulus was tallied.

<u>Heart rate</u>

1. The fastest and the slowest heartbeats for the 5 second, prestimulus period, first 5 second, second 5 second and third 5 second stimulus periods were averaged. Change scores were obtained by subtracting each 5 second period from the prestimulus baseline period.

<u>Respiration</u>

1. Frequency of respiration was determined by peak-to-peak count for each 5 second period and reduced like the heart rate data.

Results

As presented in Appendix H, Tables 1 and 2, it is apparent that the procedure used to select the subjects was successful since the groups differed significantly on the variables chosen. Therefore, the subjects chosen with respect to their scores for trait anxiety, differed significantly ($p < .001$) on the anxiety dimension, however the anxiety scores were not significantly different for the cognitive dimension. Similarly, subjects chosen with respect to their rod and frame performance obtained significantly different scores ($p < .001$) on the cognitive dimension. Their rod and frame scores, however, were unrelated to the anxiety dimension. This suggests that the anxiety and cognitive variables in this study represent, as predicted, orthogonal dimensions.

The results were examined with a multivariate analysis of variance (MANOVA) which permits a comparison of groups with reference to a system of variables. It was also possible to obtain univariate analysis of variance values. In this study, a change in a system of physiological variables was compared among groups as a function of discrete stimulus events. In addition, an intercorrelation matrix, a factor matrix and canonical correlation coefficients were obtained. The latter statistic allows for the determination of the relationship of a <u>set</u> of variables with another <u>set</u> of variables. In this study a set of physiological variables was correlated with introspective report data.

<u>Condition One</u>

It was hypothesized that conditions in which subjects could escape stressful stimuli would reduce physiological reactivity. This hypothesis

TABLE 1

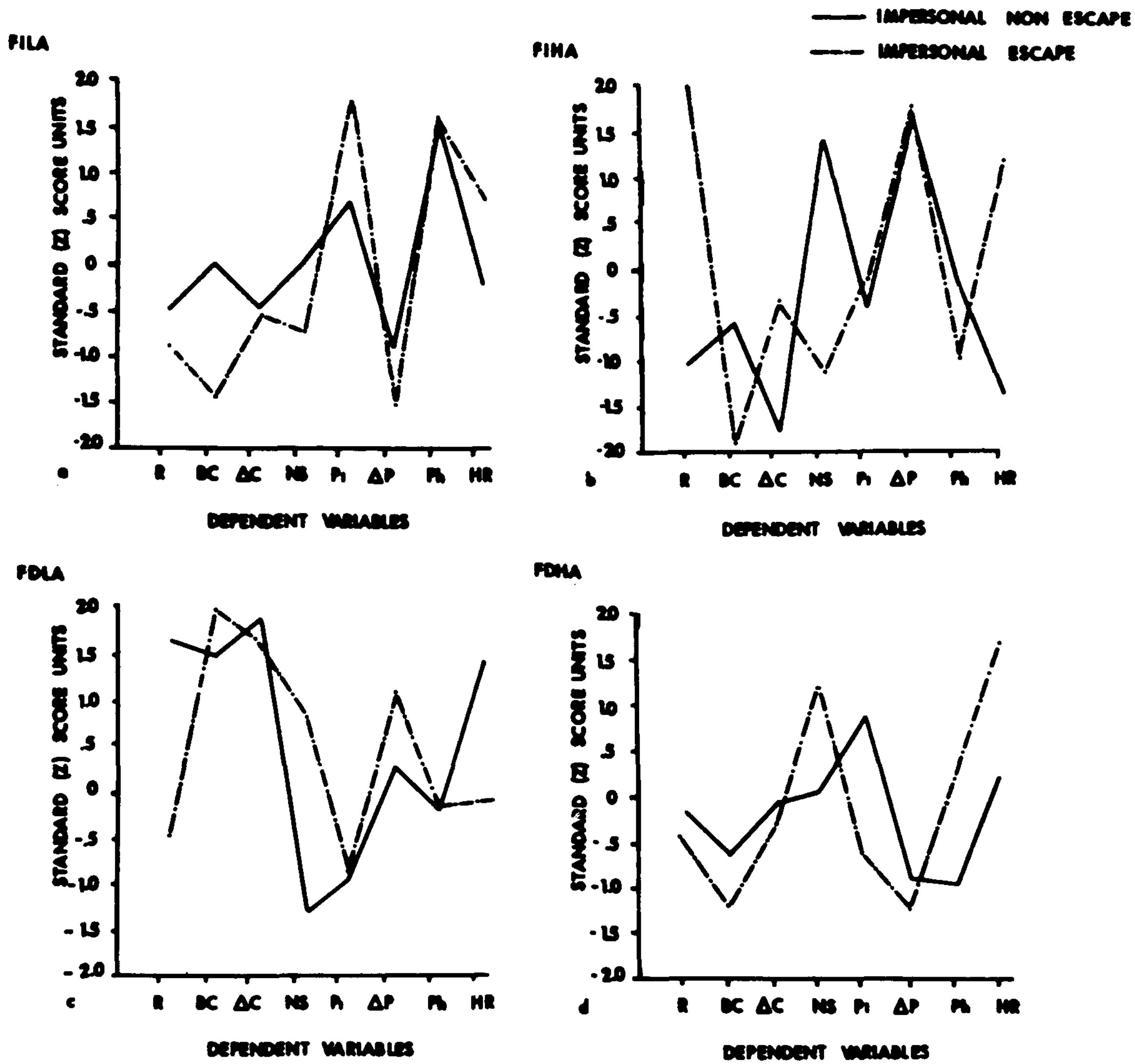
Multivariate analysis of variance of physiological response to high stress stimuli in conditions of escape and nonescape

Source	df	F
Between Subjects		
A (Cognitive Style)	8	< 1
B (Anxiety)	8	< 1
AB	8	3.40*
Error	12	
Within Subjects		
C (Stressor)	32	Asymptotic X^2 = 28.18
AC	8	1.36
BC	8	< 1
ABC	8	< 1
Error	12	

*p $< .05$

Figure 1

Illustrates different patterns of response for FILA (a), FIHA (b), FDLA (c) and FDHA (d) groups during impersonal stress and impersonal stress-escape. The values for the physiological variables are transformed into standard scores. R = respiration; BC = base conductance; ΔC = skin conductance; NS - number of nonspecific GSR's; Pi = base potential; ΔP = tonic GSP; Ph - phasic GSP and HR = heart rate.



IMPERSONAL NON ESCAPE
IMPERSONAL ESCAPE
FILA
FIHA
FDLA
FDHA
STANDARD (Z) SCORE UNITS
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
R
BC
ΔC
NS
Pt
ΔP
Ph
HR
DEPENDENT VARIABLES
a
b
c
d

was partially confirmed, however the findings were not significant for the entire system of physiological variables (Table 1). With special

Insert Table 1 About Here

emphasis on the high stress stimuli, there was a significant trend suggesting diminished physiological activity in all subjects in the escape condition. The decrease in reactivity was reflected by a significant decrease in the tonic GSP ($p < .01$), significantly fewer nonspecific GSR's ($p < .01$), and a significant deceleration in heart rate ($p < .01$).

Hypothesis two, which suggested that vigilant subjects (FI) would be the most reactive subjects, while FD subjects would be the least reactive under conditions of escape, was not confirmed. Instead, FD subjects were significantly more reactive than FI subjects on two variables, number of nonspecific GSR's ($p < .01$) and heart rate ($p < .01$). It is of interest that the general level of reactivity was not related to anxiety.

From Figures 1a, 1b, 1c and 1d, it is apparent that the four groups

Insert Figure 1 About Here

of subjects responded with idiosyncratic patterns of response for both the escape and nonescape conditions. It is readily apparent that the groups display different physiological profiles for the nonescape conditions. FILA subjects respond most significantly with an increase in phasic GSP responses. FIHA subjects display a relative increase in nonspecific GSR, increase in the tonic component of the GSP and decelerated heart rate. FDLA subjects react to nonescape conditions with increased

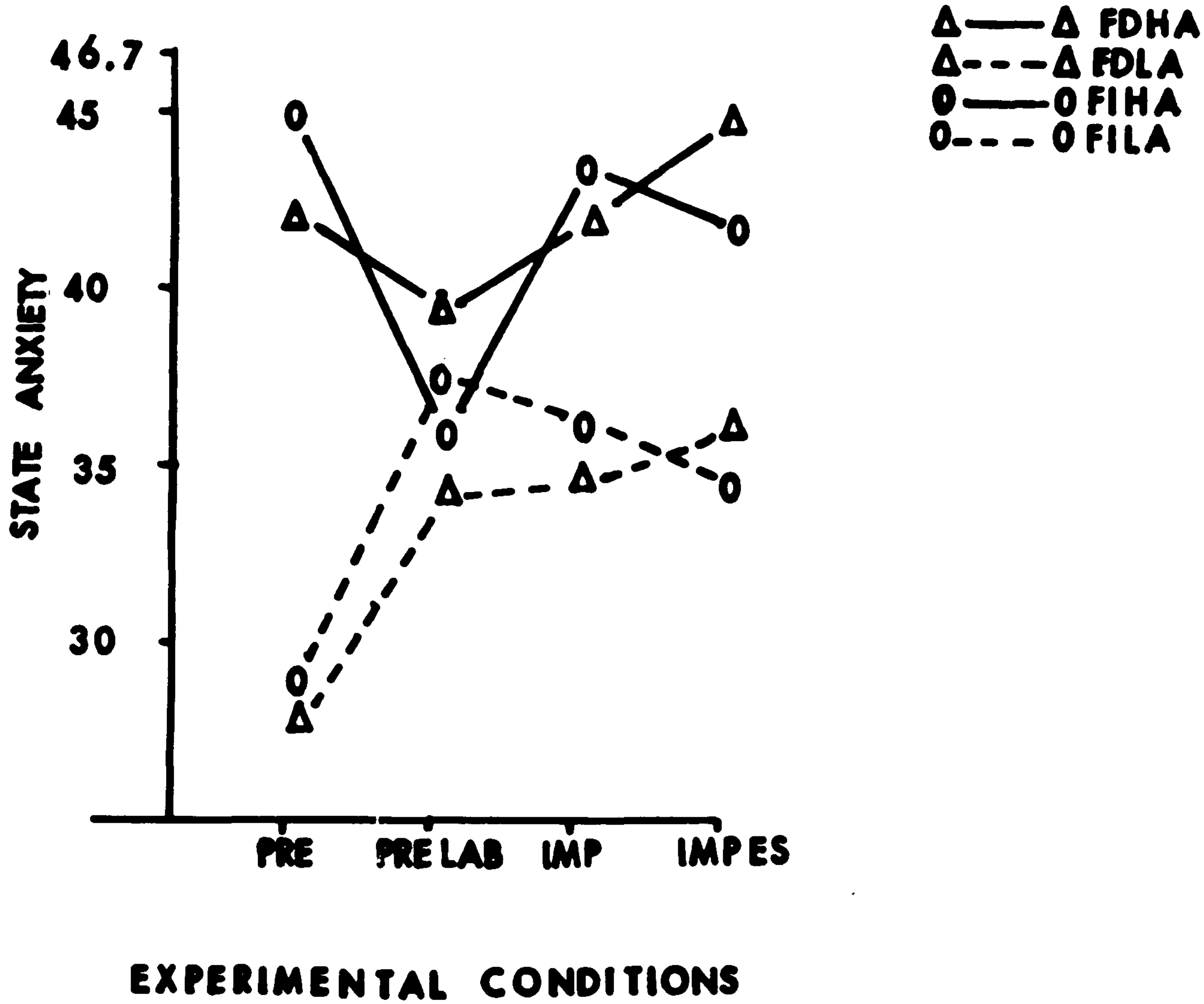
TABLE 2

Mean Viewing Time during Impersonal Stress-Escape conditions

Groups	Seconds
Field Independent - Low Anxious	10.52 ± 5.17
Field Independent - High Anxious	9.34 ± 4.36
Field Dependent - Low Anxious	8.50 ± 3.93
Field Dependent - High Anxious	9.17 ± 4.21

Figure 2

Changes in State Anxiety as a function of experimental settings. Pre = tested prior to coming to the laboratory; PreLab = tested at laboratory but before experiment; Imp = tested after impersonal stress; Impes = tested after impersonal stress-escape.


FDHA
FDLA
FIHA
FILA
46.7
45
40
35
30
STATE ANXIETY
PRE
PRE LAB
IMP
IMP ES
EXPERIMENTAL CONDITIONS

respiration, increased skin conductance (basal and ΔC) and increased heart rate. FDHA subjects respond only with an elevated base potential.

The escape conditions produce different patterns of response. The FILA subjects reveal increased base potential and heart rate. Increased respiration, phasic GSP responses and heart rate and decreased basal conductance typifies the FIHA subject. The FDLA subjects respond with an increase in basal conductance, phasic GSP, nonspecific GSR responses and tonic GSP responses to escape conditions. FDHA subjects display increased heart rate and nonspecific GSR's as well as a decrease in basal conductance and in the tonic GSP response.

Hypothesis three was that FD subjects would view the stimuli for less time than the FI subjects. As seen in Table 2, there was a trend

Insert Table 2 About Here

consistent with the hypothesis, however it failed to reach a level of statistical significance.

The fourth hypothesis was that self report measures of anxiety (STAI) would be lower in the escape condition than in the nonescape condition. Although this was not true for all subjects, from Figure 2 it is evident

Insert Figure 2 About Here

that FD subjects became more anxious in the escape condition when compared with the nonescape condition. The FI subjects became less anxious in the escape condition. From Table 3, it is apparent that the change in state

Insert Table 3 About Here

anxiety was highly related to the level of trait anxiety. These results

TABLE 3

Analysis of variance of state anxiety scores for conditions of prelaboratory, laboratory, impersonal nonescape stress and impersonal escape stress in subjects differing in cognitive style and trait anxiety

Source	df	F
Between Subjects		
A (Cognitive Style)	1	<1
B (Anxiety)	1	8.22**
AB	1	<1
Error	20	
Within Subjects		
C (Experimental Conditions)	3	1.45
AC	3	<1
BC	3	4.46**
ABC	3	<1
Error	60	

**$p < .01$

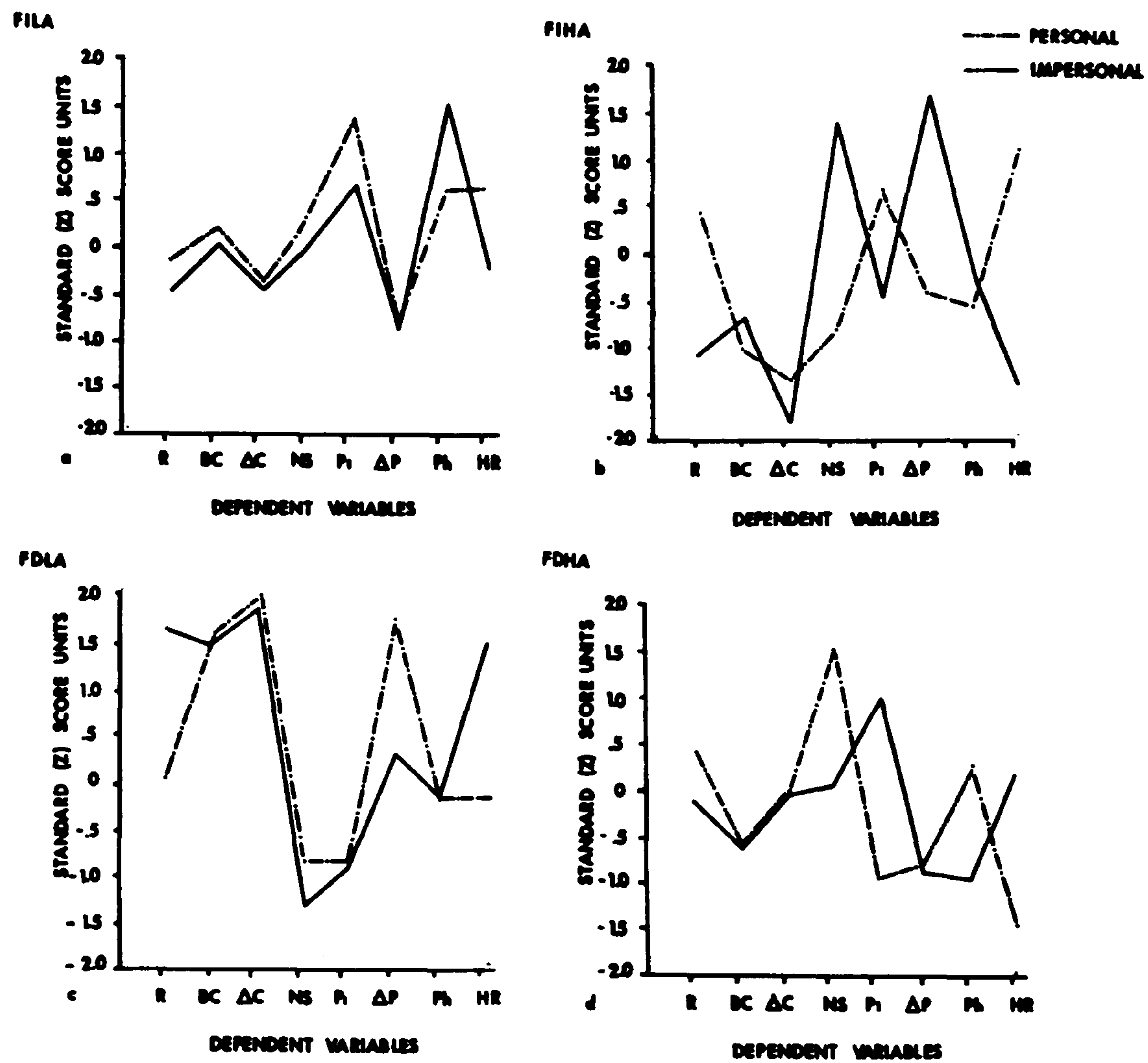
TABLE 4

Multivariate analysis of variance of physiological responses to high stress, personal or impersonal stimuli

Source	df	F
Between Subjects		
A (Cognitive Style)	8	<1
B (Anxiety)	8	<1
AB	8	1.33
Error	12	
Within Subjects		
C (Stressor)	32	Asymptotic $X^2 = 42.82$
AC	8	<1
BC	8	<1
ABC	8	1.10
Error	12	

Figure 3

Illustrates different patterns of response for FILA (a), FIHA (b), FDLA (c) and FDHA (d) groups during impersonal and personal stress. The values for the physiological variables are transformed to standard scores (see Figure 1 for Legend).



FILA
FIHA
FDLA
FDHA
PERSONAL
IMPERSONAL
STANDARD (Z) SCORE UNITS
2.0
1.5
1.0
.5
0
-.5
-1.0
-1.5
-2.0
R
BC
ΔC
NS
Pi
ΔP
Ph
HR
DEPENDENT VARIABLES
a
b
c
d

are consistent with the findings for the physiological dimension since FI subjects reported lower levels of anxiety as well as decreased physiological activity during the escape condition. Conversely, FD subjects reported increased anxiety and evidenced greater physiological reactivity during the escape conditions.

Condition Two

It was hypothesized that personally involving stress would result in greater physiological reactivity than impersonal stress. This hypothesis was partially confirmed. A difference in reactivity between impersonal and personal high stress stimuli failed to reach statistical significance for the entire system of physiological variables (Table 4), however a

Insert Table 4 About Here

significant rise in heart rate ($p < .01$), number of phasic GSP responses ($p < .05$), and number of nonspecific GSR responses ($p < .01$) followed personal stress. An accompanying decrease in tonic GSP responses was also significant ($p < .01$).

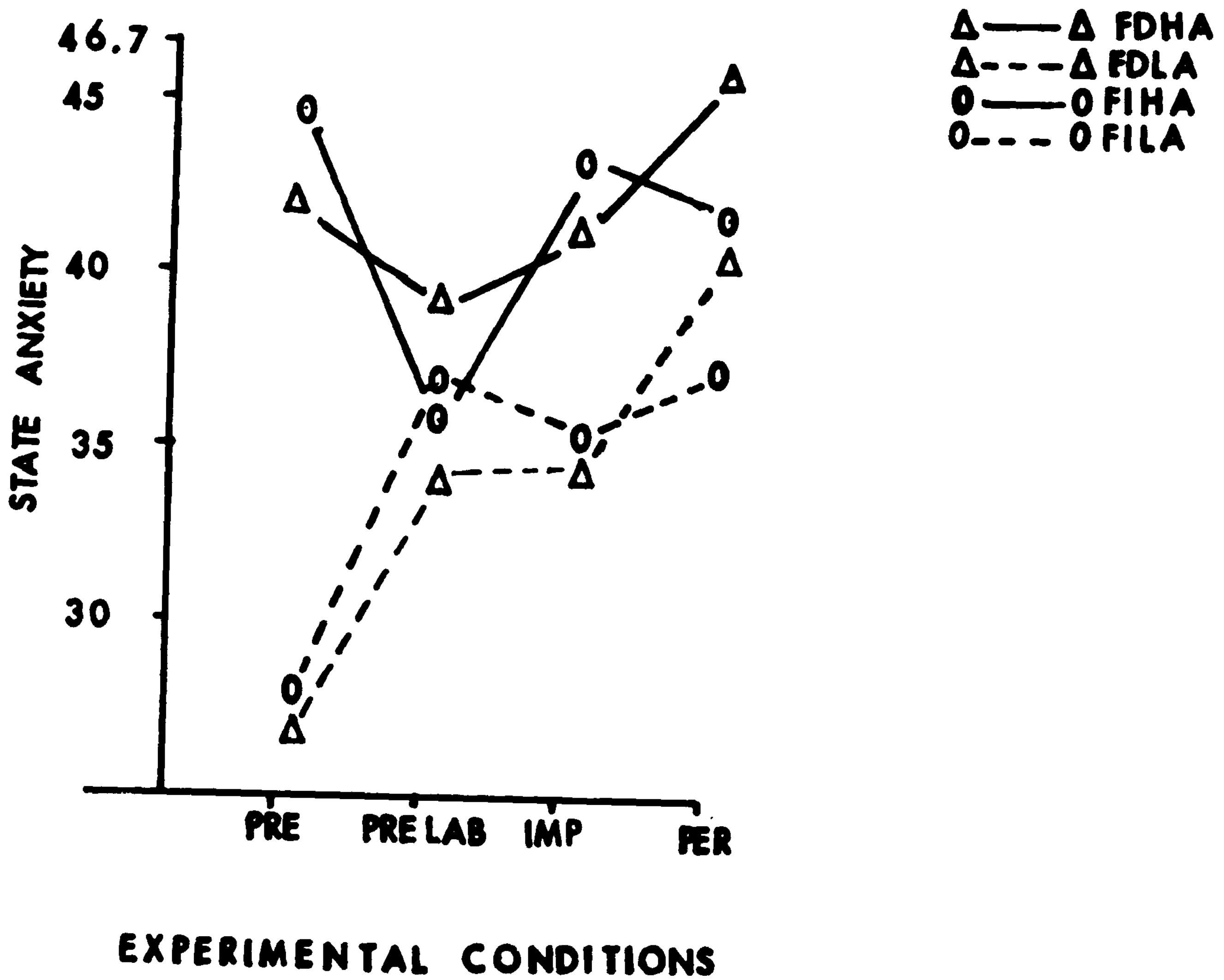
Figures 3a, 3b, 3c and 3d, illustrate the different patterns of

Insert Figure 3 About Here

response for each group of subjects. It is apparent from an inspection of the figures that there is greater physiological differentiation of personal and impersonal stress by the HA subjects (Figures b and d). For the FIHA subjects, the differentiation is greatest for nonspecific GSR's tonic GSP responses, and heart rate. There is less differentiation for the FDHA subjects, however there is a difference in nonspecific GSR's, base potential, phasic GSP responses and heart rate.

Figure 4

Changes in State Anxiety as a function of experimental manipulations. (Legend is the same as for Figure 2 except, Per = tested after personal stress)



46.7
45
40
35
30
STATE ANXIETY
PRE
PRE LAB
IMP
PER
EXPERIMENTAL CONDITIONS
Δ——Δ FDHA
Δ- - -Δ FDLA
0——0 FIHA
0- - - 0 FILA

TABLE 5

Analysis of variance of state anxiety scores for conditions of prelaboratory, laboratory, impersonal, and personal stress in subjects differing in cognitive style and trait anxiety

Source	df	F
Between Subjects		
A (Cognitive Style)	1	<1
B (Anxiety	1	6.12**
AB	1	<1
Error	20	
Within Subjects		
C (Experimental Conditions)	3	3.17*
AC	3	<1
BC	3	4.45**
ABC	3	<1
Error	60	

*$p < .05$
**$p < .01$

TABLE 6

Multivariate analysis of variance of physiological response to high stress and neutral stimuli in subjects differing in cognitive style and trait anxiety

Source	df	F
Between Subjects		
A (Cognitive Style)	8	2.01
B (Anxiety)	8	< 1
AB	8	1.79
Error	12	
Within Subjects		
C (Stressor)	32	Asymptotic $X^2 = 52.28$**
AC	8	2.75*
BC	8	1.96
ABC	8	1.03
Error	12	

*$p < .05$
**$p < .01$

Hypothesis two was confirmed since, as seen in Figure 4, personal

Insert Figure 4 About Here

stress resulted in a significant rise in anxiety when compared with impersonal stress (Table 5). Although the high trait anxious groups dis-

Insert Table 5 About Here

played the highest state anxiety scores for personally involving stress, the LA groups reported the greatest change in state anxiety.

Condition Three

It was hypothesized that patterns of physiological responding would differentiate FI and FD subjects with respect to stress and nonstress stimuli. This hypothesis was examined by comparing distress stimuli with neutral or pleasurable stimuli. As seen in Table 6, when compared with

Insert Table 6 About Here

neutral stimuli, distressful stimuli results in a significantly ($p < .01$) different pattern of response for the entire system of physiological variables across all subjects. Stress stimuli results in a significant elevation in both skin conductance and the phasic component of the GSP responses. Further, the interaction between cognitive style and stressor was significant ($p < .05$) thereby confirming the hypothesis. It is evident from Figures 5a, 5b, 5c and 5d, that greater physiological differen-

Insert Figure 5 About Here

tiation obtained for the FI subjects (Figures a and b) than for the FD subjects (Figures c and d). The FI subjects responded to stressful

Figure 5

Changes in physiological profiles for FILA (a), FIHA (b), FDLA (c) and FDHA (d) groups in response to high stress, neutral or pleasurable stimuli. Physiological scores are expressed as standard scores. (Legend is the same as for Figure 1)

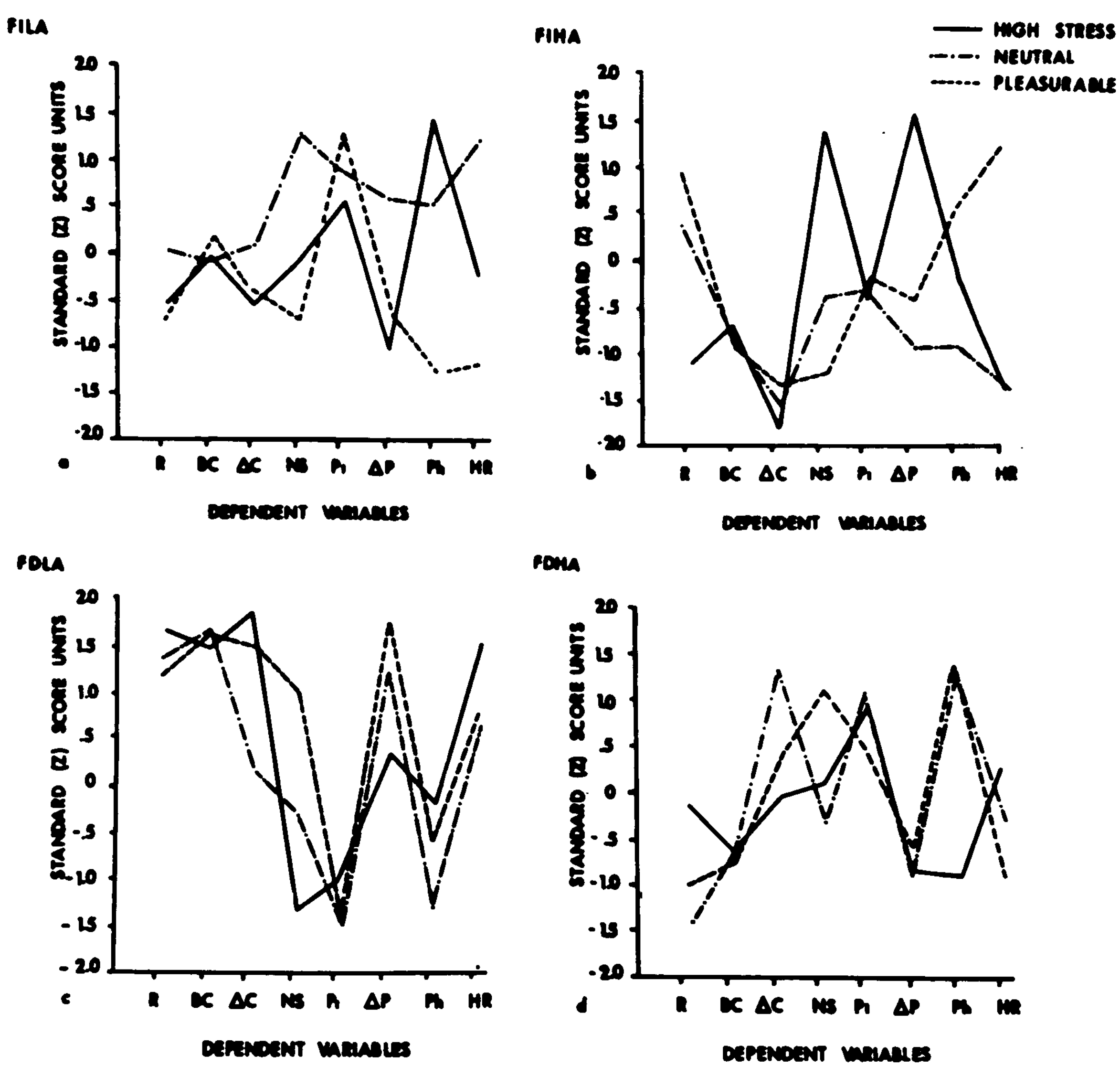

FILA
FIHA
FDLA
FDHA
HIGH STRESS
NEUTRAL
PLEASURABLE
STANDARD (Z) SCORE UNITS
DEPENDENT VARIABLES
R
BC
ΔC
NS
ΔP
HR
a
b
c
d

Figure 6

Illustrative polygraph recordings of physiological responses for FI subjects during stress, neutral and pleasurable stimuli.

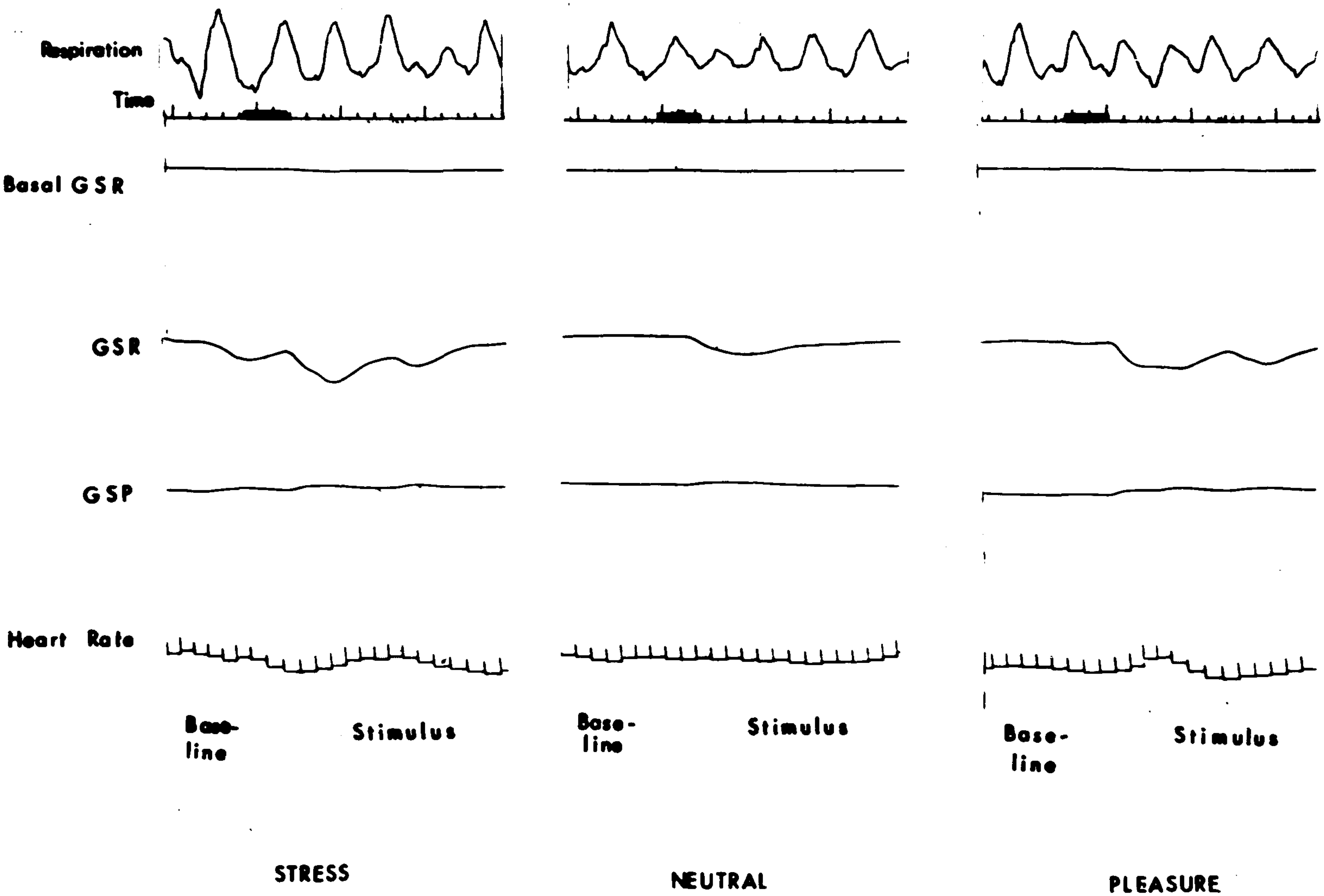

Respiration
Time
Basal GSR
GSR
GSP
Heart Rate
Base-line
Stimulus
Base-line
Stimulus
Base-line
Stimulus
STRESS
NEUTRAL
PLEASURE

Figure 7

Illustrative polygraph recordings of physiological responses in FD subjects during stress, neutral and pleasurable stimuli.

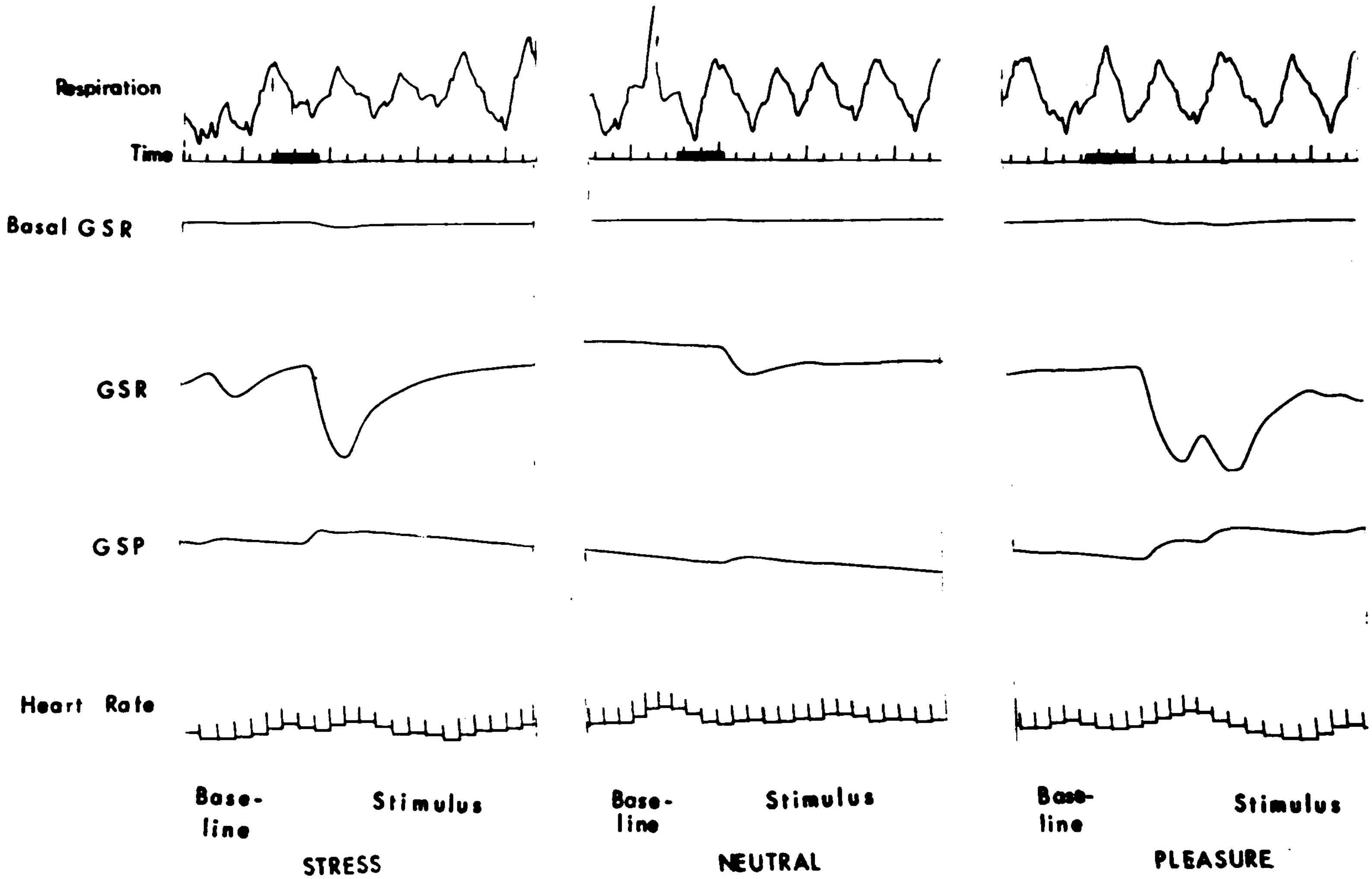

Respiration
Time
Basal GSR
GSR
GSP
Heart Rate
Base-line
Stimulus
STRESS
Base-line
Stimulus
NEUTRAL
Base-line
Stimulus
PLEASURE

TABLE 7

Multivariate analysis of variance of physiological responses to high stress and pleasurable stimuli in subjects differing in cognitive style and trait anxiety

Source	df	F
Between Subjects		
A (Cognitive Style)	8	< 1
B (Anxiety)	8	< 1
AB	8	< 1
Error	12	
Within Subjects		
C (Stressors)	32	Asymptotic X^2 = 59.76**
AC	8	3.72*
BC	8	3.24*
ABC	8	1.32
Error	12	

*p $< .05$
**p $< .01$

stimuli generally with an increase in the phasic component of the GSP response and decreased heart rate. Examples of FI and FD subjects' responses to stress, neutral and pleasurable stimuli are presented in Figures 6 and 7.

Insert Figures 6 and 7 About Here

From Table 7, it is apparent that a significantly different ($p < .01$) pattern of response exists for stressful and pleasurable stimuli. When compared with pleasurable stimuli, stressful stimuli result in heart

Insert Table 7 About Here

rate deceleration, decreased tonic GSP responses and decreased nonspecific GSR responses. The major components of the significant ($p < .05$) interaction between cognitive style and stressors was the relative increase in nonspecific GSR's to pleasurable stimuli for the FD subjects, and the relative increase in the tonic GSP response to stress by FI subjects. The significant interaction ($p < .05$) between anxiety and stressors was due largely to HA subjects response to stress with the phasic GSP response whereas the LA subjects responded to stress with the tonic GSP response.

Figures 5a, 5b, 5c and 5d, illustrate again that FD subjects failed to differentiate, physiologically, stressful and pleasurable stimuli. It is readily apparent that different patterns of physiological responding exist among the groups as well as within the groups. The groups, with the exception of the FILA group, responded in the predicted direction. The FIHA group displayed a cognitive mode of response to distress with a relative increase in base conductance, tonic GSP response, phasic GSP response, and nonspecific GSR's as well as heart rate deceleration. As predicted the FD subjects did not differentiate stress, neutral and pleasurable stimuli as well as FI subjects and responded to stress with increased skin conductance and heart rate acceleration.

It was also hypothesized that the physiological patterns of response would correlate higher for FI subjects than for FD subjects. From Tables 1-13 (Appendix I) it is apparent that by employing the Spearman product moment correlation coefficient, the correlations between physiological and self report measures are very low and nonsignificant. The correlations do, however, rise slightly by calculating intragroup coefficients. It is also evident that the correlations among the physiological measures rise by calculating intragroup coefficients.

A factor analysis (Tables 1-13, Appendix J) of the correlation matrix confirms the seeming independence of the physiological from the psychological variables. It is of interest to note that the order of the factors is altered within the groups as a function of the type of stress condition the subjects encountered. It is also apparent that there is clear statistical separation between physiological variables. Of incidental interest is the finding that a clear two factor order pertains to EDR phenomena.

Since the concern of this portion of the paper is with the relationship of physiological variables with psychological variables, a canonical correlation was computed. A canonical correlation permits a comparison of a system of variables with another system of variables. Since the physiological system does not respond as isolated components, this approach seems far more logical than comparing just two variables at a time. A canonical correlation of .15 yielded a chi-square value of 19.46 which was significant ($p < .05$) with 10 degrees of freedom (Table 8).

TABLE 8

Canonical correlation coefficients

Source	Canonical Correlation	Chi Square	Degrees of Freedom	p Value
All Data Combined	.15	19.46	10	.03
Impersonal Stress				
FILA	.57	24.76	14	.04
FIHA	.64	32.83	14	.01
FDLA	.36	9.05	14	ns
FDHA	.42	12.17	14	ns
Impersonal Escape				
FILA	.35	8.70	10	ns
FIHA	.25	4.18	10	ns
FDLA	.47	16.50	10	ns
FDHA	.32	7.12	10	ns
Personal Stress				
FILA	.50	18.09	14	ns
FIHA	.45	13.98	14	ns
FDLA	.41	11.78	14	ns
FDHA	.47	15.87	14	ns

TABLE 9

Subject's reaction to the experiment: Percentage of subjects within each group

Groups	Categories						
	1	2	3	4	5	6	7
Field Independent - Low Anxious	0	0	0	0	100	0	0
Field Independent - High Anxious	0	33	0	0	50	17	0
Field Dependent - Low Anxious	0	50	0	0	33	0	17
Field Dependent - High Anxious	17	50	0	0	33	0	0

As predicted, an increase in physiological reactivity was associated with

Insert Table 8 About Here

reported increases in distress except for heart rate.

Canonical correlations were obtained for each group of subjects within each stress condition. From Table 8, it is apparent that, as predicted, only correlations between physiological variables for FI subjects were significant (FILA-Impersonal stress, $p < .05$; FIHA-Impersonal stress, $p < .01$). However, contrary to hypothesis two, personal stress did not result in the highest canonical correlation coefficients.

Incidental Findings

Table 9 summarizes the subject's reaction to the experiment. It is

Insert Table 9 About Here

of interest to note that, consistent with theoretical speculation, FI subjects checked the statement which was intended to measure intellectualization defensive sets (see Appendix G for a list of the statements). This tendency was exaggerated in highly defended subjects (LA). FD subjects responded in a manner which indicated suggestibility or a passive acceptance of the premise of the experiment.

Discussion

The results of this study clearly indicate that different experimental operations produce different profiles of autonomic responses in different groups of subjects. Not only are different profiles apparent but they were predicted from a theoretical rationale. These findings are at variance with a large portion of the literature which suggest unidimensional sympathetic nervous system arousal as an index of emotional behavior and the literature which suggests that general principles of physiological responding apply to all subjects. The results of this study are, however, in agreement with several investigators who have made intensive studies of fractionated response systems (Lacey, et al., 1963; Davis, 1957; Dykman, et al., 1968; Miller, 1967).

The Effects of Escape on the Physiological Response to Stress

The effects of escape on the physiological response to stress was a decrease in reactivity for three variables, tonic GSP, number of nonspecifics and heart rate. These results are consistent with the data on lower organisms in which avoidance (Weiss, 1968), escape (Miller, 1969) or organized behavior (Conner, Levine, Vernikos-Danellis, 1970) led to a reduction in physiological activity. It has also been reported in human subjects that some form of organized behavior (Cannon, 1929) or control of the stimulus contingencies (Wachetel, 1968; Haggard, 1943; Stotland and Blumenthal, 1968) leads to a decrease in physiological activity. In studies (Goldstein and Adams, 1967; Mandler, et al., 1961) related to the present study, it was found that the avoidance of stressful stimuli resulted in a decrease in skin conductance. Although it has been demonstrated that "short circuiting" of stressful input results in decreases in GSR or heart rate (Weinstein, et al., 1968) there are no direct data concerning the effects of escape of stressful stimuli on physiological responses. The results of this study, however, bear a close resemblance to findings of other paradigms and operations. Not only are phylogenetic relationships suggested but the parallel between defensive maneuvers in terms of defense mechanisms and literal escape are apparent. Although Lazarus reports unidimensional short-circuiting of response systems, a general decrease in reactivity is consistent with the present findings. In addition to suggesting a general decrease in reactivity, the results of this study also indicate that escape conditions result in different patterns of response and these patterns are particular for different personality groups. It was predicted that FD subjects would be the least reactive under conditions of escape since escape is consistent with their style of dealing with the environment. While the FD subjects did view the stimuli for less time than FI subjects, the FD subjects were, contrary to the hypothesis, more reactive than FI subjects. Also, when compared with the nonescape condition, FD subjects evidenced a rise in reported anxiety. It may be that a condition in which a normally passive subject, such as the FD subject (Carrigan, 1967; Adevai, Silverman & McGough, 1968) is required to engage in a proactive exchange with the environment and in fact determine the amount of stressful stimuli he views, is of greater consequence in determining his response than the reputed defensive style he holds. Therefore the escape conditions which require decisions are at variance with the FD subjects' passive acceptance of the environment and this may have resulted in the increase in reported anxiety and the greater physiological reactivity.

The interrelationship of the three variables which differentiated the escape and nonescape conditions is not completely clear. Lacey has presented clear evidence that heart rate deceleration is associated with environmental intake and Miller (1967) has concluded tonic GSP increases are associated with cognitive activity whereas nonspecific GSR responses are associated with stress. It might therefore be reasoned that the constellation of responses associated with escape behavior constitute a vigilant approach or preparedness for action. Rather than reflecting cognitive activity, this pattern may suggest sensorimotor readiness such as might be found in reaction time experiments (Lacey, Kagan, Lacey and Moss, 1963).

It is significant to note that FI subjects responded with fewer nonspecific GSR's and decelerated heart rate in response to escape conditions to a significantly greater extent than FD subjects. This supports the general hypothesis that FI subjects would respond in a more vigilant--attentive--mode of response. Since the impersonal stress conditions do not constitute ego threat it is significant to note that trait anxiety was not related to changes in physiological responses.

The Effects of Personal and Impersonal Stress

When compared with impersonal stress, personal stress resulted in significant rises in heart rate, number of phasic GSP's and nonspecific GSR's. A corresponding decrease in tonic GSP was also recorded. It was apparent that personal stressors produced different patterns of physiological responses than impersonal stressors. The pattern of response elicited with personal stress might be termed an anxiety response since increases in phasic GSP and nonspecific GSR has been related to stress (Katkin, 1965; Miller and Shmavonian, 1965; Miller, 1967). The tonic

GSP has been related to cognitive activity (Miller, 1967) and this was noted to decrease. In addition, an increase in reported anxiety accompanied the personal stress condition. The data indicate, as suggested by others (Dykman, et al., 1968; Saltz, 1970; Waters, 1970), that personal stress is more anxiety provoking than impersonal stress. Since personal stress more closely fits the notion of signal anxiety the reaction it produces probably reflects the defensive style of the subjects more accurately than artificial defensive sets (Lazarus, 1967).

Basically, there were four different patterns of responses for personal stress in the different groups. FI subjects responded to personal stress with an elevated base potential and increased heart rate when compared with impersonal stress. This suggests a cognitive component in the FI subject's response to personal stress. It is worthy of mention that HA subjects, generally, responded with greater physiological differentiation than LA subjects. This may be indicative of less effective defensive apparatus in the HA groups whereas the LA subjects responded much more as they did in the impersonal condition. Consistent with this is the fact that HA groups reported the highest state anxiety following the personal stress condition. It also appears that the HA groups did respond in a disorganized way (Hodges and Spielberger, 1966) since there are no consistent patterns for the FIHA and the FDHA subjects in the personal stress condition.

<u>Autonomic Fractionation</u>

The use of a multivariate analysis of variance brought into clear perspective the differences between groups with respect to the entire physiological system. This approach seems very logical since the physiological system is just that--a system and not isolated (univariate) components reacting independently. Using the same logic, a canonical correlation is the most appropriate approach to correlating physiological data. Since many theorists talk in terms of factors or components, the use of a factor analysis is especially revealing. It was apparent that, for the most part, the physiological systems expressed their effects in different and unique directions. It was also significant that different subjects and different conditions resulted in different ordering of the factors. Of significance was the finding that, in terms of factors, the reaction to stress does indeed result in two electrodermal factors. One factor is phasic and has been related to stress, the other is tonic and has been related to cognitive activity.

The effects of stressful, neutral and pleasurable stimuli resulted in significantly different patterns of response for all subjects. It was readily apparent that FI subjects displayed very <u>different</u> response profiles while FD subjects' response profiles reflected changes in the <u>degree</u> of response. In terms of Lacey's finding (Lacey, et al., 1962), FI subjects responded as would be predicted from situational stereotypy of response principles whereas FD subjects responded consistent with Lacey's notion of intrastressor stereotypy of response. From the present study it is apparent that Lacey's principles and response types are valid for group comparisons as well as comparisons for individuals. This adds a degree of generalizability to the work done by Lacey.

The failure of an interaction between cognitive style and anxiety to exert an influence on the physiological response patterns suggests that these personality variables selectively affect the response systems examined. Generally, a mode of response which has been described as an attentive or vigilant approach characterized the FI subject's response to stress while a pattern of sympathetic arousal or orientation away from the environment characterized the FD subject's response to stress. HA subjects responded to stress with increased phasic GSP activity and LA subjects responded to stress with increased tonic GSP activity. These findings are highly consistent with findings in which anxiety or stress externally induced resulted in increased phasic activity (Miller, 1967).

Conclusions

The present study presents data which strongly suggest that personality variables are valid predictors of the physiological response to stimuli. It might be speculated that FI subjects operate with respect to the theory of emotional responding proposed by James. They, for the most part, displayed greater physiological differentiation in the different conditions as well as responding with wide variation in response to stress and nonstress stimuli. For the FI subjects, different levels of stress resulted in activation in different response systems. FD subjects, on the other hand, responded in degree rather than by fractionation. The FD subjects seemed to have responded in terms of unidimensional arousal as suggested by Cannon.

It might be concluded that FI and FD subjects treat stressful stimuli in different ways. FD subjects, who depend on external cues and are more perceptually oriented, may tend to deal with stressful stimuli by blocking their input. By diminishing the threat value of the stimulus by filtering it at the external level, in terms of rejection of (Lacey, 1962), or orientation away from, the environment (Glad and Glad, 1963) a more primitive form of response, both psychological and physiological, may result. This form of filtering of stimuli is consistent with the psychological defense, denial. The unidimensional arousal pattern displayed by the FD subjects may reflect a more primitive, less differentiated psychological system. The fact that Cannon's theory fits the response patterns of FD subjects more closely than Fl subjects may be due to the fact that Cannon's experimental data was based largely on lower organisms such as the cat. From this reasoning, Cannon's theory describes the emotional response of a primitive system. Certainly, this is not intended to equate FD subjects with lower organisms but to illustrate that they operate at a less differentiated level than FI subjects.

FI subjects displayed an attentive or vigilant approach to stressful stimuli. It might be predicted that they "filter" the stimuli in a more cognitive manner, as indeed the results of this study suggested. By allowing access to the stimuli input, the FI subjects responded with a "richer" physiological profile of response. There were clearly three different profiles for stress, neutral and pleasurable stimuli in the FI subjects. These patterns of response, possibly reflecting three different arousal or emotional states, are consistent with the speculations of James. It would appear that the FI subject has greater physiological differentiation and this might be related to greater psychological differentiation.

The results of this study indicate that attentive and cognitive factors are associated with, in a predictable way, physiological responses to stress. It might, therefore, prove productive to examine the "emotional" response in terms of these factors. By such an analysis perhaps a further fractionation of physiological response systems would be possible.

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Appendix A

Latin Square Design Presenting the Order in Which the Subjects were Tested.

Independent Variables	Subjects		Design		
HA FI	6	11	Impersonal Stress	Impersonal Escape	Personal Stress
HA FD	3	17			
LA FI	1	7			
LA FD	12	13			
HA FI	14	20	Impersonal Escape	Personal Stress	Impersonal Stress
HA FD	4	5			
LA FI	15	19			
LA FD	2	18			
HA FI	8	10	Personal Stress	Impersonal Stress	Impersonal Escape
HA FD	22	24			
LA FI	21	23			
LA FD	9	16			

Appendix B

Screening Procedure for

the Rod and Frame Test.

Procedure for Portable RFT

(Description and Instructions Prepared by the Darro Products Corporation)

Before Seating S in Front of Apparatus

"In this test we want to find out how well you can determine the upright--the vertical--under various conditions."

"In this box (PRFT) you will see a square frame and within this frame you will see a rod."

"It is possible for me to tilt the frame to the left or the right. I can also tilt the rod to the left or right. I can tilt the frame alone or the rod alone; or I can tilt them both at the same time, either to the same or to opposite sides."

"When I illuminate the rod and frame at the beginning of each trial, I want you to tell me whether the rod and frame are straight up and down--i.e. vertical--or whether they are tilted. In other words, tell me whether the rod and frame are straight with the walls of this room or whether they are tilted."

"Are there any questions?"

Seat S in Front of Apparatus and Adjust Head Rest

Trial 1: Adjust the frame to 28L and the rod to 28L. Illuminate the rod and frame. Say to S: "What is the position of the rod and the frame?" (Record S's response.)

If S says the rod is not vertical, say to him:

> "I will now turn the rod slowly until you think it is straight with the walls of this room. As I said, I will turn it slowly, and after each turn, tell me whether it has been turned enough or whether you want it turned some more. Just say 'more' or 'enough' after each turn. Please make your decisions quickly and don't be too finicky. Which way shall I move the rod to make it vertical--clockwise or counter-clockwise?"

Now move the rod about 3 degrees at a time opposite to the direction in which the S says it is tilted, until he reports "enough." Ask the S after he reports the rod vertical:

> "Is the rod now vertical, that is, is it straight with the walls of this room? In other words, is it straight up the way the flagpole outside is?"

If the S should now say that he wants the rod moved some more in either direction, do so. Raise the curtain and record the position of the rod and the time.

If on this first trial, the S reports the rod to be straight at the outset, ask him the question?

> "Is the rod now vertical, that is, is it straight with the walls of this room?"

In such an instance, give the S the instructions concerning the straightening of the rod, as above, on the next trial. If on the next trial, the S again states that the rod is straight at the outset, give him these instructions on the first trial on which he says that the rod is tilted.

Trial 2: Leave the frame at 28L and adjust the rod to 28R. Illuminate the rod and frame and say to the S:

> "Would you tell me now and at the beginning of all subsequent trials whether the rod and frame are straight with the walls of this room, or tilted; and if the rod is tilted, whether the rod should be moved clockwise or counter-clockwise to be made straight."

If the S asks you to turn the rod, do so until he says "enough."

Ask him again:

> "Is the rod now vertical--that is, is it straight with the walls of this room?"

Do not ask this question on subsequent trials. Raise curtain. Record adjustment and time. Proceed to the next trials.

Trial 3

Trial 4

Before S enters the room, be sure frame is straight and curtain up.

If at any time after the rod has been adjusted on a given trial the S should say that he wants it moved some more in either direction, do so.

If the S should take more than 5 seconds on any trial before saying "more" or "enough," tell him:

"Please make your decision quickly."

If the S should repeatedly say "more" or "enough" before the turn of the rod is completed, say to him:

"Please wait until I have completed the turn."

Check from time to time to determine whether the S's head is in proper position in the head rest.

Appendix C

Screening Procedure for

State and Trait Anxiety.

SELF-EVALUATION QUESTIONNAIRE

Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI Form X-2

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you <u>generally</u> feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

NAME______________________________ DATE_______________

		Almost Never	Sometimes	Often	Almost Always
21.	I feel pleasant	1	2	3	4
22.	I tire quickly.	1	2	3	4
23.	I feel like crying.	1	2	3	4
24.	I wish I could be as happy as others seem to be	1	2	3	4
25.	I am losing out on things because I can't make up my mind soon enough.	1	2	3	4
26.	I feel rested	1	2	3	4
27.	I am "calm, cool, and collected".	1	2	3	4
28.	I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
29.	I worry too much over something that really doesn't matter.	1	2	3	4
30.	I am happy.	1	2	3	4
31.	I am inclined to take things hard	1	2	3	4
32.	I lack self-confidence.	1	2	3	4
33.	I feel secure	1	2	3	4
34.	I try to avoid facing a crisis or difficulty.	1	2	3	4
35.	I feel blue	1	2	3	4
36.	I am content.	1	2	3	4
37.	Some unimportant though runs through my mind and bothers me.	1	2	3	4
38.	I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39.	I am a steady person.	1	2	3	4
40.	I become tense and upset when I think about my present concerns	1	2	3	4

SELF-EVALUATION QUESTIONNAIRE

Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI Form X-1

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

NAME____ DATE________________

	Not At All	Somewhat	Moderately So	Very Much So
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I am regretful	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel rested	1	2	3	4
9. I feel anxious	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel "high strung"	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel over-excited and rattled	1	2	3	4
19. I feel joyful	1	2	3	4
20. I feel pleasant	1	2	3	4

Appendix D

Distress Rating Scale.

Distress Rating Scale

I FELT

1 Extremely pleasurable or relaxed

2 Very pleasurable or relaxed

3 Moderately pleasurable or relaxed

4 Pleasurable or relaxed

5 Neutral

6 Distressed

7 Moderately distressed

8 Very distressed

9 Extremely distressed

DURING THE LAST SLIDE.

Appendix E

Instructions to the Subjects.

Instructions

Familiarize yourself with this distress scale. During the experiment you will be asked to rate how you feel. In a normal tone of voice rate how you feel by telling me which numbered statement best described your feeling state. So, if you feel NEUTRAL you would say "5".

Relax.

Impersonal Stress

In this study certain physiological responses to pictures are being studied. Try to remain as still as possible and watch the screen in front of you. Immediately after each slide the rating scale will appear on the screen and you are to rate how you felt during the picture.

Impersonal Avoidance

In this study certain physiological responses to pictures are being studied. Try to remain as still as possible and watch the screen in front of you. You will see the picture for a given period of time, however you may turn the picture off by pressing the key on your right with your right index finger. Only press the key one time for each picture and only during the picture. It will take a few seconds for the picture to change after you press the key. Immediately after each slide the rating scale will appear on the screen and you are to rate how you felt during the picture.

Personal Stress

As you remember, you have taken several psychological tests prior to participating in this experiment. From the psychological tests several conclusions concerning your personality have been derived. The following slides consist of statements derived about you as determined by your test data. Following each slide the rating scale will appear on the screen and you are to rate your reaction to the slide.

Appendix F

Description of Slides

and Mean Ratings.

Stimuli And Mean Ratings By An Independent Sample

Impersonal Stressors	Mean Rating	± SD
1 Road and Mountain Scene	3.58	1.12
2 Autopsy Male	7.81	.98
3 Clothed Male	4.65	.66
4 Car Accident	6.30	1.27
5 Clothed Female	3.36	.98
6 Nude Couple	3.19	1.31
7 Autopsy Male	6.92	.94
8 Autopsy Female	6.30	1.20
9 Earthquake Damage	6.03	1.40
10 Nude Female	2.81	1.54
11 Nude Male	6.00	1.34
12 Autopsy Female	7.59	1.22
Impersonal Escape Stressors		
1 Horse and Pasture Scene	3.68	1.21
2 Autopsy Male	7.16	1.15
3 Clothed Male	4.97	.28
4 Car Accident	6.78	1.23
5 Clothed Female	3.19	1.16
6 Nude Couple	2.92	1.30
7 Autopsy Male	6.73	1.08
8 Autopsy Female	6.95	1.14
9 Earthquake Damage	5.73	.98
10 Nude Female	2.95	.68
11 Penis	5.76	1.02
12 Autopsy Female	7.22	1.04
Personal Stressors		
1 You are Intelligent	2.62	1.17
2 You are Untruthful	7.43	1.26
3 You are Extremely Anxious	5.14	.78
4 You Experience Difficulty in Dealing with Your Problems	6.25	.83
5 You are Creative	2.97	1.13
6 You have a Great Deal of Potential	2.92	1.38
7 You are not a Likeable Person	6.92	1.22
8 You Would Benefit from Therapy	6.30	1.20
9 You are Defensive and Secretive	5.86	.81
10 You have High Goals	2.89	1.16
11 You are Inflexible	5.81	1.21
12 You are Very Immature	7.43	1.26

Appendix G

Post-experiment Questionnaire.

Check the statement which best expresses your reaction to this experiment:

_____1. I think I responded like almost everyone else.

_____2. I feel that I really learned something about myself.

_____3. It was all phony.

_____4. I did not respond like I really felt.

_____5. It was an extremely interesting experiment.

_____6. I didn't understand what it was all about.

_____7. I'm sure it accurately measures the reaction I had.

Appendix H

Analysis of the Values of

the Independent Variables.

(Two tables)

TABLE 1

Means for trait anxiety

	FIELD DEPENDENT	FIELD INDEPENDENT	
HIGH ANXIOUS	47.3	49.3	48.3±4.6
LOW ANXIOUS	35.0	32.2	33.6±3.6
	41.2±3.8	40.8±4.5	

High anxious subjects compared with low anxious subjects produces a $t = 12.5$ with 22 degrees of freedom, $p < .001$.

TABLE 2

Means for rod and frame scores

	FIELD DEPENDENT	FIELD INDEPENDENT	
HIGH ANXIOUS	7.36	1.77	4.56$\pm$2.09
LOW ANXIOUS	6.54	1.69	4.12$\pm$1.85
	7.0$\pm$3.3	1.7$\pm$0.6	

Field dependent subjects compared with field independent subjects produces a $t = 11.3$ with 22 degrees of freedom, $p < .001$.

Appendix I

Intercorrelation Matricies.

(Thirteen tables)

TABLE 1

Intercorrelation matrix combined across all conditions

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RESPIRATION PRE	-.46	-.36	-.12	-.02	.01	.07	-.17	-.04	.00	.16	-.04	-.06	-.02	-.04	.11
RESPIRATION 1		.44	.19	.00	.05	.02	.02	.00	.08	-.01	.04	.08	.05	.09	.03
RESPIRATION 2			.20	.05	.10	.04	.01	.06	.10	.03	-.02	.05	-.01	.04	-.02
RESPIRATION 3				-.04	.00	-.02	-.07	.10	.01	.02	-.03	-.01	-.08	-.02	.00
BASE CONDUCTANCE					.50	-.07	.37	-.09	.19	-.02	.01	-.02	.05	.01	.22
DELTA CONDUCTANCE						.22	.19	.07	.49	.06	.10	-.03	-.03	.04	.00
# NONSPECIFICS							-.12	.09	.26	.14	.04	-.01	-.06	-.01	-.12
BASE POTENTIAL								-.15	.25	.08	.12	.04	.06	.07	.14
DELTA POTENTIAL									-.12	-.01	.01	.01	-.04	.00	-.11
# PHASICS										.03	.08	-.02	.03	.02	.13
HEART RATE PRE											.00	-.10	-.16	.02	-.15
HEART RATE 1												.55	.50	-.07	-.26
HEART RATE 2													.64	-.05	-.30
HEART RATE 3														-.08	-.33
DISTRESS RATING															-.32
AVOIDANCE TIME															

TABLE 2

Intercorrelation matrix for Field Independent-Low Anxious Subjects during Impersonal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.45	-.54	-.55	-.07	-.06	-.16	-.52	-.12	.04	-.28	-.14	-.18	-.15	.20
RESPIRATION 1		.50	.59	-.11	-.29	-.25	.23	-.14	-.11	-.19	-.07	-.10	.10	-.06
RESPIRATION 2			.59	.17	.10	-.03	.45	.02	.02	-.03	-.12	-.21	-.12	-.03
RESPIRATION 3				-.08	-.07	-.03	.17	.09	.03	.04	-.11	-.14	-.08	.08
BASE CONDUCTANCE					.66	-.10	.66	-.16	.18	-.66	-.02	-.01	.15	-.01
DELTA CONDUCTANCE						.32	.29	.14	.50	-.20	.20	.15	.13	.15
# NONSPECIFICS							-.13	.27	.25	.48	.12	.11	-.13	-.14
BASE POTENTIAL								-.12	-.07	-.33	-.10	-.09	-.04	-.07
DELTA POTENTIAL									-.27	.36	.21	.09	-.15	-.19
# PHASICS										-.01	.10	.08	.22	.02
HEART RATE PRE											.03	.06	-.23	-.01
HEART RATE 1												.54	.46	-.27
HEART RATE 2													.66	-.15
HEART RATE 3														-.08
DISTRESS RATING														

TABLE 3

Intercorrelation matrix for Field Independent-High Anxious Subjects during Impersonal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.24	-.28	-.47	-.17	.07	.36	-.69	-.47	.05	.09	-.08	.35	.23	-.22
RESPIRATION 1		.34	.31	-.03	.20	.23	.05	-.01	.17	.16	.29	.06	.00	.26
RESPIRATION 2			.37	.00	.06	.20	.03	.02	.08	.05	-.01	-.06	-.10	.40
RESPIRATION 3				-.05	-.06	-.12	.14	.21	-.10	-.03	-.12	-.15	-.06	.19
BASE CONDUCTANCE					.17	.15	.42	.19	.03	.34	-.06	-.28	-.18	.07
DELTA CONDUCTANCE						.54	.23	.41	.63	.55	.19	-.20	-.20	.22
# NONSPECIFICS							-.02	-.12	.46	.74	.03	-.11	-.16	.14
BASE POTENTIAL								.48	.14	.43	.03	-.43	-.28	.20
DELTA POTENTIAL									.31	.01	.10	-.28	-.04	.31
# PHASICS										.29	.12	-.04	.00	.03
HEART RATE PRE											-.12	-.32	-.37	.18
HEART RATE 1												.24	.17	-.15
HEART RATE 2													.66	-.29
HEART RATE 3														-.18
DISTRESS RATING														

TABLE 4

Intercorrelation matrix for Field Dependent-Low Anxious Subjects during Impersonal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.47	-.49	-.63	-.16	-.21	-.01	-.32	.10	-.34	.10	-.14	-.14	.00	-.01
RESPIRATION 1		.11	.40	.03	.07	-.01	.16	-.03	.04	.08	.26	.08	-.02	.11
RESPIRATION 2			.56	-.14	-.01	.06	-.17	.11	.16	-.13	.02	.02	.00	.05
RESPIRATION 3				-.26	-.02	.11	-.17	.06	.12	.06	-.05	-.02	-.12	.04
BASE CONDUCTANCE					.44	-.30	.82	-.33	.30	-.41	.10	-.03	.16	-.02
DELTA CONDUCTANCE						.04	.25	.17	.44	-.17	-.15	-.25	-.18	-.03
# NONSPECIFICS							-.33	.18	.05	.01	.05	-.02	-.19	-.18
BASE POTENTIAL								-.41	.31	-.33	.16	.19	.27	.07
DELTA POTENTIAL									.04	-.26	.00	-.19	-.21	.11
# PHASICS										-.32	.00	-.13	-.13	.03
HEART RATE PRE											-.02	.02	-.05	-.07
HEART RATE 1												.52	.52	-.10
HEART RATE 2													.59	-.09
HEART RATE 3														-.11
DISTRESS RATING														

TABLE 5

Intercorrelation matrix for Field Dependent-High Anxious Subjects during Impersonal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.51	-.42	-.19	.54	.17	-.15	.15	-.13	.01	.52	.07	.07	.05	-.17
RESPIRATION 1		.33	.49	-.17	-.13	-.17	-.17	.05	-.08	-.08	-.15	-.16	-.18	.22
RESPIRATION 2			.35	-.08	.01	.02	-.06	.08	-.10	-.08	.09	-.01	-.03	-.03
RESPIRATION 3				.01	-.11	-.21	-.20	.14	-.37	-.01	-.10	-.30	-.30	.09
BASE CONDUCTANCE					.48	-.10	.68	-.07	.10	.43	.10	.03	.00	-.15
DELTA CONDUCTANCE						.36	.42	-.01	.55	.02	.02	.03	-.08	-.11
# NONSPECIFICS							.21	.15	.40	-.09	-.01	-.05	-.03	.10
BASE POTENTIAL								.02	.30	.29	.12	.04	.09	-.12
DELTA POTENTIAL									-.21	-.13	.04	.13	.00	.10
# PHASICS										.21	.04	.00	-.05	-.06
HEART RATE PRE											.18	-.10	-.15	.03
HEART RATE 1												.36	.32	-.19
HEART RATE 2													.50	-.05
HEART RATE 3														-.12
DISTRESS RATING														

TABLE 6

Intercorrelation matrix for Field Independent-Low Anxious Subjects during Impersonal Stress-Escape conditions

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RESPIRATION PRE	-.49	-.37	-.51	-.33	-.32	-.30	.02	.08	-.27	-.24	.00	.14	.25	-.11	-.27
RESPIRATION 1		.35	.46	-.07	-.05	.05	-.01	-.10	.04	.07	-.11	-.04	-.14	.08	.14
RESPIRATION 2			.24	-.02	-.14	.02	-.07	-.27	-.18	-.01	.07	.10	-.05	.03	-.03
RESPIRATION 3				-.11	-.02	.09	-.06	-.14	.16	.20	-.35	-.50	-.37	-.02	.42
BASE CONDUCTANCE					.57	.10	.44	-.20	.34	-.30	.07	-.06	.16	.19	.34
DELTA CONDUCTANCE						.25	-.08	-.05	.58	.04	.24	-.03	.12	.10	.05
# NONSPECIFICS							-.26	.16	.12	.67	.10	-.31	.02	-.07	-.17
BASE POTENTIAL								-.11	-.03	-.48	-.29	-.03	-.10	.10	.24
DELTA POTENTIAL									-.49	.36	.10	-.05	.14	-.14	-.36
# PHASICS										-.06	.22	-.09	.04	.10	.27
HEART RATE PRE											-.01	-.50	-.30	-.04	-.38
HEART RATE 1												.56	.61	.14	-.33
HEART RATE 2													.55	-.12	-.32
HEART RATE 3														-.05	-.34
DISTRESS RATING															-.31
VIEWING TIME															

TABLE 7

Intercorrelation matrix for Field Independent-High Anxious Subjects during Impersonal Stress-Escape conditions

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RESPIRATION PRE	-.50	-.64	-.60	-.34	.18	.28	-.49	.04	.07	-.03	.12	.05	.11	-.12	.04
RESPIRATION 1		.49	.62	.14	.12	-.02	.11	.04	.04	-.03	-.01	.11	.03	.11	-.01
RESPIRATION 2			.68	.29	.14	-.12	.37	-.17	.22	.48	-.19	-.14	-.21	.22	-.14
RESPIRATION 3				-.04	.05	-.21	-.02	-.02	.33	.46	-.45	-.34	-.46	.21	.08
BASE CONDUCTANCE					.04	.02	.40	-.41	-.06	.52	-.06	-.23	-.15	.05	.02
DELTA CONDUCTANCE						.42	.21	-.17	.61	.38	.42	.15	.12	.10	-.36
# NONSPECIFICS							.07	-.06	.22	.42	.31	.15	.11	.05	-.40
BASE POTENTIAL								-.23	.13	.42	.30	.29	.28	.12	-.42
DELTA POTENTIAL									-.19	-.22	-.01	.15	.14	-.13	-.04
# PHASICS										.27	.22	.14	.08	.06	-.23
HEART RATE PRE											.03	-.49	-.54	.12	-.50
HEART RATE 1												.93	.93	.06	-.43
HEART RATE 2													.97	-.16	-.33
HEART RATE 3														-.14	-.29
DISTRESS RATING															-.47
VIEWING TIME															

TABLE 8

Intercorrelation matrix for Field Dependent-Low Anxious Subjects during Impersonal Stress-Escape conditions

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RESPIRATION PRE	-.63	-.42	.31	-.25	-.12	.08	-.39	.15	.02	-.09	-.10	-.04	.01	-.11	-.08
RESPIRATION 1		.31	-.19	.14	.04	-.02	.15	-.02	-.09	-.02	.16	.21	.12	.07	-.16
RESPIRATION 2			-.02	-.02	.17	.09	-.15	.17	-.15	-.01	.12	.08	-.14	-.15	.06
RESPIRATION 3				-.14	-.07	.01	-.37	.30	.03	.13	-.02	.15	.06	-.16	.02
BASE CONDUCTANCE					.64	-.25	.77	-.39	.40	-.30	.18	.07	.17	.11	.25
DELTA CONDUCTANCE						-.11	.47	-.14	.33	-.20	.12	-.13	-.30	.18	.11
# NONSPECIFICS							-.26	.12	.05	-.21	-.26	-.31	-.35	-.03	.29
BASE POTENTIAL								-.47	.52	-.36	.30	.26	.35	.23	.16
DELTA POTENTIAL									-.40	-.18	-.21	-.24	-.36	-.13	-.02
# PHASICS										-.45	.14	.17	.07	-.10	.23
HEART RATE PRE											.07	-.05	-.03	-.05	-.40
HEART RATE 1												.47	.27	-.05	-.17
HEART RATE 2													.70	.27	-.43
HEART RATE 3														.24	-.13
DISTRESS RATING															-.41
VIEWING TIME															

TABLE 9

Intercorrelation matrix for Field Dependent-High Anxious Subjects during Impersonal Stress-Escape conditions

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RESPIRATION PRE	-.38	-.32	-.02	.44	.10	-.03	-.08	.00	.02	.50	-.17	-.27	-.45	-.01	.58
RESPIRATION 1		.47	-.06	.11	.03	.09	-.05	.05	.09	-.01	-.01	-.01	.12	.12	-.09
RESPIRATION 2			.01	-.07	-.04	-.21	.30	.12	.31	.14	-.06	.07	.08	.02	-.07
RESPIRATION 3				-.10	-.28	.18	.08	.06	-.15	-.06	.12	.22	.46	.09	-.11
BASE CONDUCTANCE					.40	.09	-.12	.26	.03	.42	-.13	-.11	-.63	-.02	.37
DELTA CONDUCTANCE						.36	.20	-.03	.56	.18	.11	.09	.02	.01	.22
# NONSPECIFICS							.11	.23	.30	-.03	.29	.34	.56	-.08	-.15
BASE POTENTIAL								-.31	.63	.65	.34	-.08	.49	.10	.25
DELTA POTENTIAL									-.23	-.21	-.06	.27	.05	-.03	-.12
# PHASICS										.40	.22	-.07	.37	-.03	.24
HEART RATE PRE											-.03	-.33	-.38	.07	.62
HEART RATE 1												.60	.37	-.08	.03
HEART RATE 2													.41	.07	-.27
HEART RATE 3														.14	-.74
DISTRESS RATING															-.13
VIEWING TIME															

TABLE 10

Intercorrelation matrix for Field Independent-Low Anxious Subjects during Personal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.53	-.38	-.43	-.25	-.26	.20	-.12	-.25	.03	-.11	.12	-.11	-.05	-.01
RESPIRATION 1		.56	.55	-.07	.10	.10	-.15	.01	.30	-.04	-.19	.19	.07	.16
RESPIRATION 2			.64	-.02	.23	.04	-.19	.00	.34	-.11	-.15	.14	.05	-.04
RESPIRATION 3				-.20	.03	-.01	-.15	.14	.22	-.01	-.14	.10	-.10	.02
BASE CONDUCTANCE					.59	-.41	.40	-.24	.08	-.61	.04	-.03	.13	.05
DELTA CONDUCTANCE						-.17	.04	-.11	.46	-.40	.06	.15	.13	.11
# NONSPECIFICS							-.10	-.01	.07	.26	.06	.04	.05	.08
BASE POTENTIAL								.02	-.32	-.14	.11	-.04	.02	-.02
DELTA POTENTIAL									-.47	.33	.27	.43	.15	-.15
# PHASICS										-.23	-.14	-.07	-.05	.11
HEART RATE PRE											-.18	-.08	-.20	.00
HEART RATE 1												.58	.47	.03
HEART RATE 2													.61	.17
HEART RATE 3														-.10
DISTRESS RATING														

TABLE 11

Intercorrelation matrix for Field Independent-High Anxious Subjects during Personal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.21	-.24	-.29	-.19	.25	.23	-.62	-.30	.33	-.02	.01	-.10	.01	-.02
RESPIRATION 1		.53	.61	-.18	.14	.10	-.17	-.12	.16	-.05	.25	.36	.28	-.11
RESPIRATION 2			.42	-.11	.15	.03	-.13	-.01	.08	-.07	.27	.49	.29	.06
RESPIRATION 3				-.08	.04	.11	-.10	-.36	.08	-.02	.21	.10	.30	-.05
BASE CONDUCTANCE					.02	-.07	.18	.22	-.02	.12	.06	-.03	.03	.10
DELTA CONDUCTANCE						.64	.00	.27	.76	.59	.32	.20	.24	-.03
# NONSPECIFICS							-.04	.01	.49	.41	.11	.01	.14	.12
BASE POTENTIAL								.35	-.04	.42	.04	-.01	.02	.02
DELTA POTENTIAL									.06	.18	.05	.17	-.04	-.05
# PHASICS										.62	.23	.12	.23	-.08
HEART RATE PRE											-.09	-.21	-.15	.03
HEART RATE 1												.52	.56	-.08
HEART RATE 2													.52	.01
HEART RATE 3														-.26
DISTRESS RATING														

TABLE 12

Intercorrelation matrix for Field-Dependent-Low Anxious Subjects during Personal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.72	-.63	-.59	-.49	-.27	.09	-.57	.30	-.44	.28	.10	.10	-.14	.17
RESPIRATION 1		.64	.51	.34	.18	-.11	.32	-.13	.28	-.22	-.07	.09	.25	-.19
RESPIRATION 2			.45	.25	.16	.00	.17	.12	.23	-.24	-.17	.09	.19	-.21
RESPIRATION 3				.12	.06	-.24	.08	-.14	.05	-.10	-.22	-.13	-.04	-.14
BASE CONDUCTANCE					.65	-.17	.77	-.23	.53	-.35	.08	.26	.30	-.14
DELTA CONDUCTANCE						-.19	.39	-.11	.53	-.12	.03	.10	.19	-.05
# NONSPECIFICS							-.10	-.04	-.11	-.06	-.05	-.03	-.12	-.24
BASE POTENTIAL								-.34	.55	-.22	.22	.31	.34	-.08
DELTA POTENTIAL									-.35	-.23	-.12	-.06	-.04	.09
# PHASICS										-.27	.01	.21	.26	-.05
HEART RATE PRE											-.10	-.41	-.38	.01
HEART RATE 1												.57	.55	-.01
HEART RATE 2													.75	.00
HEART RATE 3														.00
DISTRESS RATING														

TABLE 13

Intercorrelation matrix for Field Dependent-High Anxious Subjects during Personal Stress

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RESPIRATION PRE	-.61	-.15	-.37	.67	.19	.10	.03	.10	.05	.36	-.21	-.15	-.02	.00
RESPIRATION 1		.54	.51	-.34	-.12	.02	.13	-.03	.04	-.02	.18	.14	.01	.24
RESPIRATION 2			.31	.07	-.04	.07	.08	.18	-.04	.29	.17	.03	-.03	.08
RESPIRATION 3				-.11	-.16	-.11	.17	-.01	-.11	.14	.17	-.03	-.08	.14
BASE CONDUCTANCE					.27	.20	.01	.20	.03	.31	-.23	-.10	.00	.08
DELTA CONDUCTANCE						.64	.09	.14	.57	-.07	-.11	-.18	-.17	.09
# NONSPECIFICS							-.25	.07	.40	-.26	-.11	.00	-.12	-.02
BASE POTENTIAL								.10	.28	.73	.17	.24	.04	.20
DELTA POTENTIAL									-.14	.06	-.09	-.14	.01	-.08
# PHASICS										.00	.11	.02	.08	.03
HEART RATE PRE											.10	.16	-.01	.11
HEART RATE 1												.49	.41	-.05
HEART RATE 2													.51	.06
HEART RATE 3														.08
DISTRESS RATING														

Appendix J

Varimax Rotated Factor Matricies.

TABLE 1

Varimax Rotated Factor matrix for variables collapsed across all subjects and conditions

Variables	Factors and Factor Loadings				
	1	2	3	4	5
RESPIRATION PRE	-.15	.81	-.23	.07	.02
RESPIRATION 1	.18	-.68	.44	.13	-.14
BASE CONDUCTANCE	.68	-.01	-.38	-.07	.31
DELTA CONDUCTANCE	.79	.20	.16	-.10	.28
# NONSPECIFICS	.22	.39	.67	.05	-.11
BASE POTENTIAL	.58	-.22	-.42	.08	-.19
DELTA POTENTIAL	-.14	.05	.45	-.27	.54
# PHASICS	.70	.17	.21	.03	-.10
HEART RATE PRE	.10	.34	.14	.44	-.45
HEART RATE 1	.21	-.04	.10	-.54	-.49
DISTRESS RATING	.09	-.16	.07	.69	.25

TABLE 2

Varimax Rotated Factor matrix for Field Independent-Low Anxious Subjects during Impersonal Stress

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.81	-.14	-.30	-.23	.08	.05
RESPIRATION 1	.77	-.21	-.42	.02	-.02	-.13
RESPIRATION 2	.78	.22	.04	-.20	.06	-.02
RESPIRATION 3	.85	-.09	.04	-.06	.09	.12
BASE CONDUCTANCE	-.06	.95	-.16	.01	.05	.03
DELTA CONDUCTANCE	-.10	.70	.31	.08	.40	-.10
# NONSPECIFICS	.00	-.03	.72	-.06	.37	-.11
BASE POTENTIAL	.39	.76	-.05	-.08	-.21	.01
DELTA POTENTIAL	-.02	.06	.70	.06	-.45	-.13
# PHASICS	.05	.04	.00	.06	.93	.00
HEART RATE PRE	.13	-.52	.72	-.04	.04	.07
HEART RATE 1	-.04	-.02	.13	.71	-.03	-.24
HEART RATE 2	-.04	-.02	.12	.89	-.05	.04
HEART RATE 3	.06	.02	-.27	.87	.12	.06
DISTRESS RATING	.00	.03	.03	.02	.00	.99

TABLE 3

Varimax Rotated Factor matrix for Field Independent-High Anxious Subjects during Impersonal Stress

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.29	-.79	-.06	.10	.04	-.24
RESPIRATION 1	.03	.30	.11	-.03	.20	.75
RESPIRATION 2	-.12	.84	.04	.11	.01	-.26
RESPIRATION 3	-.20	.84	-.10	-.06	.00	.17
BASE CONDUCTANCE	.91	-.12	.01	-.12	.04	-.04
DELTA CONDUCTANCE	.59	-.07	-.21	.36	-.25	.35
# NONSPECIFICS	-.28	.07	-.02	.28	-.60	.09
BASE POTENTIAL	.85	-.01	.16	-.25	.15	.04
DELTA POTENTIAL	-.27	-.03	-.03	.86	.90	.00
# PHASICS	.58	.30	-.20	.25	-.20	-.04
HEART RATE PRE	-.50	-.15	-.10	-.52	-.11	.46
HEART RATE 1	.06	-.07	.80	.26	-.13	.36
HEART RATE 2	-.09	.08	.84	-.09	-.03	-.04
HEART RATE 3	.06	-.03	.84	-.08	.04	-.17
DISTRESS RATING	-.01	.00	-.12	.26	.83	.17

TABLE 4

Varimax Rotated Factor matrix for Field Dependent-Low Anxious Subjects during Impersonal Stress

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.25	.54	-.37	-.24	-.27	-.31
RESPIRATION 1	-.05	.20	.65	.49	-.15	-.02
RESPIRATION 2	-.06	.11	.82	-.10	-.06	-.06
RESPIRATION 3	.05	-.28	.68	-.04	.05	.00
BASE CONDCUTANCE	-.12	.15	-.08	-.09	-.05	.91
DELTA CONDUCTANCE	.11	.68	-.03	.15	.52	-.03
# NONSPECIFICS	.03	.92	.13	.00	-.11	.06
BASE POTENTIAL	.23	-.10	.02	.15	.31	.65
DELTA POTENTIAL	-.02	-.13	.03	-.03	.89	.13
# PHASICS	-.07	.58	-.05	.15	.58	-.14
HEART RATE PRE	.24	.73	.04	-.03	-.10	.41
HEART RATE 1	-.10	.00	-.08	.86	.04	-.04
HEART RATE 2	-.82	.01	.01	.16	-.13	-.06
HEART RATE 3	-.97	-.08	.04	-.02	.14	.10
DISTRESS RATING	.06	.14	.59	-.38	.31	-.04

TABLE 5

Varimax Rotated Factor matrix for Field Dependent-High Anxious Subjects during Impersonal Stress

Variables	Factors and Factor Loadings						
	1	2	3	4	5	6	7
RESPIRATION PRE	.27	-.11	-.24	-.66	-.01	-.10	.32
RESPIRATION 1	.04	-.07	-.16	.76	-.16	.32	-.06
RESPIRATION 2	.01	.00	.05	.79	.08	-.22	.14
RESPIRATION 3	.10	-.41	-.41	.54	.21	-.04	.06
BASE CONDUCTANCE	.91	.01	-.19	-.07	.01	-.04	.12
DELTA CONDUCTANCE	.66	-.04	.48	.07	-.01	-.13	-.18
# NONSPECIFICS	-.04	-.16	.84	-.06	.29	.02	-.02
BASE POTENTIAL	.81	.15	.18	.03	.06	.03	.01
DELTA POTENTIAL	.07	.04	.03	-.01	.91	.11	-.03
# PHASICS	.17	.01	.76	.03	-.39	.06	.10
HEART RATE PRE	.18	-.21	-.02	-.12	-.14	.19	.80
HEART RATE 1	-.12	.44	.13	.17	.11	-.24	.66
HEART RATE 2	.07	.83	-.03	-.03	.13	.08	.05
HEART RATE 3	.07	.85	-.17	-.03	-.07	-.02	-.09
DISTRESS RATING	-.05	.05	.06	.04	.11	.93	.06

TABLE 6

Varimax Rotated Factor matrix for Field Independent-Low Anxious Subjects during Impersonal Stress-Escape conditions

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.39	-.56	-.49	-.23	-.09	-.21
RESPIRATION 1	.14	.19	.63	.52	-.21	.31
BASE CONDCUTANCE	.76	.19	-.19	-.04	.48	.04
DELTA CONDUCTANCE	.50	.61	-.31	-.21	.13	-.09
# NONSPECIFICS	-.18	.75	.19	-.16	.24	-.28
BASE POTENTIAL	.47	-.48	.02	.18	.55	-.08
DELTA POTENTIAL	-.60	.13	-.03	-.06	.55	.42
# PHASICS	.64	.42	-.18	-.16	-.38	-.15
HEART RATE PRE	-.54	.67	.26	-.06	.08	-.27
HEART RATE 1	-.06	.39	-.62	.07	-.24	.50
DISTRESS RATING	.15	.15	-.36	.80	.05	-.29
VIEWING TIME	.64	-.25	.46	-.36	-.08	.11

TABLE 7

Varimax Rotated Factor matrix for Field Independent-High Anxious Subjects during Impersonal Stress-Escape conditions

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	.05	.80	.13	.23	-.06	-.21
RESPIRATION 1	-.01	-.91	.21	.27	.02	-.14
BASE CONDUCTANCE	.56	-.22	-.51	-.19	-.13	.00
DELTA CONDUCTANCE	.19	-.04	-.03	.80	-.01	.19
# NONSPECIFICS	.64	.20	.34	.29	-.01	.01
BASE POTENTIAL	.23	-.27	-.25	-.14	.01	.70
DELTA POTENTIAL	-.03	-.14	.89	-.24	-.10	.00
# PHASICS	-.02	-.08	-.20	.87	.03	.01
HEART RATE PRE	.90	.02	-.09	.06	.06	-.02
HEART RATE 1	-.17	.14	.12	.26	-.03	.83
DISTRESS RATING	-.06	-.05	-.10	-.02	.98	-.09
VIEWING TIME	-.34	-.05	-.27	-.03	-.55	-.41

TABLE 8

Varimax Rotated Factor matrix for Field Dependent-Low Anxious Subjects during Impersonal Stress-Escape conditions

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.14	.14	-.89	.06	.09	.10
RESPIRATION 1	-.10	.08	.89	.07	.13	.17
BASE CONDUCTANCE	.81	.10	.12	-.05	-.17	-.03
DELTA CONDUCTANCE	.80	.11	-.04	.11	.05	-.11
# NONSPECIFICS	-.60	.53	.10	.01	-.17	-.38
BASE POTENTIAL	.58	.26	.20	.08	-.34	.15
DELTA POTENTIAL	-.05	.17	.00	-.05	.94	-.04
# PHASICS	.12	.57	-.17	-.11	-.49	.22
HEART RATE PRE	-.18	-.90	.03	.01	-.25	-.03
HEART RATE 1	-.01	.10	.10	-.05	-.10	.88
DISTRESS RATING	.12	.11	.03	.93	-.08	-.17
VIEWING TIME	.18	.25	.05	-.70	-.07	-.38

TABLE 9

Varimax Rotated Factor matrix for Field Dependent-High Anxious Subjects during Impersonal Stress-Escape conditions

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	.67	.20	.19	-.49	.03	.02
RESPIRATION 1	.02	.06	.08	.96	.00	-.01
BASE CONDUCTANCE	.58	.29	.47	.17	-.03	.25
DELTA CONDUCTANCE	.00	.15	-.01	-.02	-.02	.94
# NONSPECIFICS	-.22	-.39	.47	-.05	-.01	.54
BASE POTENTIAL	.35	-.62	-.36	.05	.20	.14
DELTA POTENTIAL	-.01	-.09	.87	.06	.05	-.13
# PHASICS	.13	-.25	-.33	.08	.00	.69
HEART RATE PRE	.88	-.19	-.12	.07	.15	.02
HEART RATE 1	-.01	-.87	.18	-.03	-.14	-.05
DISTRESS RATING	-.04	.05	.06	-.01	.98	-.02
VIEWING TIME	.86	-.03	-.05	-.03	-.21	-.03

TABLE 10

Varimax Rotated Factor matrix for Field Independent-Low Anxious Subjects during Personal Stress

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	-.69	.27	.04	.25	-.09	.37
RESPIRATION 1	.87	.06	.02	-.03	.13	.15
RESPIRATION 2	.80	.19	.05	.12	-.17	.04
RESPIRATION 3	.86	-.06	-.06	.06	-.08	.07
BASE CONDUCTANCE	-.05	.47	.05	-.42	.06	-.54
DELTA CONDUCTANCE	.12	.48	.19	.09	.19	-.52
# NONSPECIFICS	.10	.09	.13	-.09	.11	.87
BASE POTENTIAL	.02	.01	-.02	-.94	.01	.08
DELTA POTENTIAL	.11	-.76	.38	.05	-.09	-.20
# PHASICS	.22	.68	-.06	.45	.11	.00
HEART RATE PRE	.00	-.71	-.23	.19	.15	.20
HEART RATE 1	-.24	-.01	.81	-.06	.02	.08
HEART RATE 2	.12	-.15	.87	.10	.17	-.02
HEART RATE 3	.03	.14	.81	-.05	-.18	.09
DISTRESS RATING	-.04	.01	.02	-.01	.96	.04

TABLE 11

Varimax Rotated Factor matrix for Field Independent-High Anxious Subjects during Personal Stress

Variables	Factors and Factor Loadings 1	2	3	4	5	6
RESPIRATION PRE	.00	.22	-.91	-.18	-.04	.03
RESPIRATION 1	.24	.10	.16	.54	-.02	-.45
RESPIRATION 2	.41	.03	.17	.30	.27	-.46
RESPIRATION 3	.08	.07	.18	.89	-.01	-.06
BASE CONDUCTANCE	.23	-.01	.23	.00	.23	.77
DELTA CONDUCTANCE	.24	.88	-.08	-.11	.02	-.07
# NONSPECIFICS	-.01	.75	-.18	.11	.18	-.01
BASE POTENTIAL	-.06	.13	.81	-.14	-.10	.23
DELTA POTENTIAL	.21	.15	.48	-.69	-.01	-.16
# PHASICS	.09	.85	-.18	.07	-.10	-.01
HEART RATE PRE	-.34	.84	.31	.01	-.01	.07
HEART RATE 1	.81	.10	-.04	.06	-.07	.20
HEART RATE 2	.84	-.06	.04	-.16	.13	-.21
HEART RATE 3	.76	.06	-.05	.20	-.30	.19
DISTRESS RATING	-.06	.04	-.05	.00	.94	.11

TABLE 12

Varimax Rotated Factor matrix for Field Dependent-Low Anxious Subjects during Personal Stress

Variables	Factors and Factor Loadings					
	1	2	3	4	5	6
RESPIRATION PRE	.22	.03	-.80	-.09	.21	-.04
RESPIRATION 1	-.02	.09	.84	-.03	-.03	-.08
RESPIRATION 2	-.02	.01	.79	.07	.27	-.14
RESPIRATION 3	.18	-.13	.84	-.26	-.09	-.02
BASE CONDUCTANCE	-.86	.07	.08	.00	-.03	-.04
DELTA CONDUCTANCE	-.92	-.09	-.13	-.23	.12	-.14
# NONSPECIFICS	.16	-.11	-.15	.87	-.08	-.21
BASE POTENTIAL	-.63	.20	.13	.10	-.31	.06
DELTA POTENTIAL	.09	-.05	-.08	-.07	.91	-.02
# PHASICS	-.71	-.01	.08	.15	-.20	.16
HEART RATE PRE	.20	-.28	-.23	-.42	-.46	-.28
HEART RATE 1	.10	.87	-.21	-.15	-.17	-.14
HEART RATE 2	-.02	.87	.01	.10	.04	.07
HEART RATE 3	-.06	.87	.12	-.05	.09	.02
DISTRESS RATING	.10	-.05	-.14	-.15	-.01	.90

TABLE 13

Varimax Rotated Factor matrix for Field Dependent-High Anxious Subjects during Personal Stress

Variables	Factors and Factor Loadings						
	1	2	3	4	5	6	7
RESPIRATION PRE	-.86	.11	.02	-.03	-.21	-.02	-.03
RESPIRATION 1	.47	.00	.06	.03	.65	.23	.00
RESPIRATION 2	-.14	.02	.01	.04	.89	-.06	.10
RESPIRATION 3	.20	.13	-.14	-.14	.68	.08	-.09
BASE CONDUCTANCE	-.89	-.03	.09	-.01	.13	.11	.07
DELTA CONDUCTANCE	-.08	.04	.86	-.14	-.07	.07	.14
# NONSPECIFICS	-.17	-.39	.77	.02	.19	-.03	.02
BASE POTENTIAL	.11	.96	.12	.04	-.04	.09	.10
DELTA POTENTIAL	.03	.07	.00	.01	.03	-.05	.99
# PHASICS	.12	.27	.84	.07	-.10	-.03	-.16
HEART RATE PRE	-.40	.80	-.14	.01	.21	-.03	-.04
HEART RATE 1	.15	.13	.06	.69	.21	-.26	-.09
HEART RATE 2	.00	.08	.00	.81	.02	.02	-.11
HEART RATE 3	-.06	-.11	-.07	.86	-.14	.15	.13
DISTRESS RATING	-.04	.05	.00	.03	.02	.95	-.06

VITA of Charles Curtis Alan Sandman

I was born May 28, 1941, in Santa Cruz, California. I married the former Judy Rosengren and have two children, Sandi and Kelli.

I attended Cabrillo College, received four varsity athletic awards and an A. A. degree (1959-1961). In 1962 I attended Fresno State College, majored in psychology and received my B.A. (1964) and M.A. (1967). I was elected to Phi Kappa Phi at Fresno State College (1967). In 1967 I began graduate study at Louisiana State University. The summers of 1968 and 1969 were spent as a V.A. trainee in New Orleans. I interned at Louisiana State University Medical Center in 1969-70. Following the internship I remained at the Medical Center as a researcher in psychophysiology (1970-71). During my graduate training I have published 14 articles on projective techniques, psychotherapy, neuroendocrine influences on behavior and psychophysiology.

EXAMINATION AND THESIS REPORT

Candidate: Charles Curtis Alan Sandman

Major Field: Clinical Psychology

Title of Thesis: Psychophysiological Parameters of Emotional Expression

Approved:

[illegible]

Major Professor and Chairman

Max Goodrich

Dean of the Graduate School

EXAMINING COMMITTEE:

[illegible]

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Lyle V. Miller

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Date of Examination:

September 10, 1971